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WATSON (M. A.) & SINHA (R. C.). **Studies on the transmission of European wheat striate mosaic virus by** *Delphacodes pellucida* **Fabricius.**—*Virology* **8** no. 2 pp. 139–163, 4 figs., 22 refs. New York, N.Y., 1959.

The following is virtually the authors' summary of this account of investigations at Rothamsted on *Calligypona* (*Delphacodes*) *pellucida* (F.) transmitting the virus of European wheat streak mosaic to wheat [*cf. R.A.E.*, A **47** 407].

Several races of *C. pellucida* were isolated that transmitted the virus with varying degrees of efficiency. The length of the incubation period in the vectors increased as the proportion of insects that were able to transmit infection decreased. Efficient races of *C. pellucida* transmitted virus to a high proportion of their progeny, but nymphs of inefficient races inherited little or no virus, even from infective mothers. Congenitally infective inbred lines did not become more infective after feeding on infected plants, but insects that did not inherit virus could usually acquire it with about the same efficiency as that of the parent race. Females of an efficient race that became infective as a result of feeding on infected plants as nymphs, 15 days before mating, transmitted virus to eggs laid from 10 to 15 days after mating, but females fed on infected plants only during mating usually did not transmit to their progeny, though they were able to infect plants within 15 days of acquiring virus. Infective mothers that fed on infected plants as nymphs had 40 per cent. fewer progeny than did those fed on healthy plants. Some embryos died in the egg at a comparatively late stage of development, and it is probable that the virus was pathogenic to them. The poor reproductive ability of infective females tends to eliminate the virus from colonies that are unable to renew their infectivity by feeding on infected plants.

JENSEN (D. D.). **A plant virus lethal to its insect vector.**—*Virology* **8** no. 2 pp. 164–175, 2 graphs, 26 refs. New York, N.Y., 1959.

The following is virtually the author's summary. The peach yellow leafroll strain of Western X-disease virus [*cf. R.A.E.*, A **46** 496, etc.] was shown to cause the premature death of its Cicadellid vector, *Colladonus montanus* (Van D.) [*cf.* **47** 484]. Celery was used as virus source plants and as test plants [*cf.* **45** 202]. In one type of experiment, leafhoppers from a single colony were divided into two equal groups. One group was caged on diseased celery for 21 days, while the control group fed only on healthy celery. Later, 15 insects from each group were tested singly for virus transmission and length of life. Twelve leafhoppers that transmitted virus had a mean life of 38 days compared to 82 days for the non-infective controls. The remaining insects from each of the two main groups were tested in groups of 10. The mean life of these infective and non-infective groups was 24 and 51 days, respectively. In other experiments, all leafhoppers were caged on diseased plants and were subsequently tested individually for virus transmission and longevity. In 14 such experiments, the mean life of 116 leafhoppers that transmitted virus was 20 days compared to 51 days for the 64 non-transmitting individuals. These results indicate that the virus itself shortens the life of leafhoppers that acquire it and that the differences in survival period cannot be accounted for on the basis of altered physiology of diseased plants. This appears to be the first record of a plant virus that eventually kills its insect vector, and it adds to the plausibility of the theory that plant viruses may have evolved from arthropod viruses.

Bradley (R. H. E.). **Loss of virus from the stylets of aphids.**—*Virology* **8** no. 3 pp. 308–318, 4 figs., 14 refs. New York, N.Y., 1959.

The following is virtually the author's summary of this account of experiments carried out to ascertain the stage during feeding at which an aphid ceases to transmit a virus carried at the tips of the stylets.

When green peach aphids (*Myzus persicae* (Sulz.)) carrying potato virus Y probed into healthy tobacco plants, they usually ceased to transmit virus within a few minutes. In tests to determine what caused this, similar numbers of aphids stopped transmitting virus when they had probed the same amount into different species of plants, onion epidermis, or a solid membrane that contained no liquid. Thus the effect seems not to depend on the type of material probed or on the presence of cell liquids round the stylets. Nor does it depend on the ejection of saliva itself, for this alone did not reduce the numbers of aphids that transmitted virus. Virus Y was washed from the stylets simply by inserting them into water a few times, and aphid juice, which inhibits virus *in vitro*, did not reduce the numbers of aphids that transmitted virus Y when it was applied to the stylets of aphids carrying the virus. None of these results, or those of other workers [*cf. R.A.E.*, A **28** 301, etc.], conflict with the hypothesis that probing causes aphids to cease transmitting virus Y primarily because virus is scoured from the stylets as they penetrate; nor is it necessary to postulate that saliva round the penetrating stylets adversely affects virus carried by them.

Smith (K. M.) & Rivers (C. F.). **Cross-inoculation studies with the *Tipula* iridescent virus.**—*Virology* **9** no. 1 pp. 140–141, 1 ref. New York, N.Y., 1959.

Tests are reported in which the *Tipula* iridescent virus [a cytoplasmic virus affecting the fat-body cells of the larvae of *T. paludosa* Mg., having particles icosahedral in shape (*R.A.E.*, A **47** 158)] was successfully transmitted to larvae of *T. oleracea* L., *T. livida* Wulp, several unidentified species of the same genus, *Bibio marci* (L.), *Calliphora vomitoria* (L.), *Pieris brassicae* (L.) and *Tenebrio molitor* L. The characteristic iridescent pellet was isolated in each case, and all the infected larvae showed iridescence of the fat-body.

Gösswald (K.) & Kloft (W.). **Zur Laboratoriumsprüfung von Textilien auf Termitenfestigkeit mit *Kalotermes flavicollis* Fabr.** [Laboratory testing of textiles for termite resistance with *K. flavicollis*.]—*Ent. exp. appl.* **2** no. 4 pp. 268–278, 2 figs., 20 refs. Amsterdam, 1959. (With a summary in English.)

The following is based on the authors' summary. Experiments were carried out for two years in Germany on the resistance of various materials, especially textiles, to termites. *Kalotermes flavicollis* (F.) was used as the test species, as it is resistant to environmental conditions and readily attacks hard materials. Quantitative radiobiological investigations showed that fifth-instar nymphs and pseudergates (supplementary or secondary reproductives) were good test insects, both feeding actively. The nymphs do not feed for four days after moulting, and it is advisable to use large batches (about 30 insects) to ensure that some feeding is possible at any time. Experiments should last at least 21 days; the methods used are described. A useful new technique consists of stretching the textile over the metal frame of a projector slide. It was found that termites can gnaw through materials otherwise

resistant when they are covered by a thin perforated film of termite-proof material, perforations of the same size as the termite's head permitting feeding. This method can be used for tests of repellents.

Auclair (J. L.). **Feeding and excretion by the pea aphid,** *Acyrthosiphon pisum* **(Harr.) (Homoptera: Aphididae), reared on different varieties of peas.**—*Ent. exp. appl.* **2** no. 4 pp. 279–286, 18 refs. Amsterdam, 1959. (With a summary in French.)

The following is virtually the author's summary. The amount of honeydew excreted by *Macrosiphum* (*Acyrthosiphon*) *pisum* (Harris) reared singly and in groups on susceptible and resistant varieties of peas grown in the greenhouse was measured. Excretion by isolated aphids was interrupted at moulting for mean periods of 12 and 16 hours, and between moults and in the adult stage for mean periods of 3 to 15 hours, although in many cases the aphids remained in the feeding position. Droplet volume, frequency, and rate of excretion were generally proportional to the susceptibility of the plant variety on which the aphids were feeding. The rate of feeding on susceptible varieties was higher and contributed therefore to the faster rate of aphid growth; a greater proportion of the material ingested was excreted and a lesser proportion assimilated than on resistant varieties. Honeydew from aphids feeding on susceptible varieties usually contained a slightly higher concentration of free amino acids and amides.

Davis (G. R. F.). **Effects of sterilized flax seed and sterilized soil on feeding behaviour and growth of larvae of** *Ctenicera aeripennis aeripennis* **(Kby.) (Coleoptera: Elateridae).**—*Ent. exp. appl.* **2** no. 4 pp. 295–299, 3 refs. Amsterdam, 1959. (With a summary in French.)

The following is based on the author's summary. When larvae of *Ctenicera aeripennis aeripennis* (Kby.) of medium or large size (averages 43·1 and 110·6 mg.) were reared in sterilised or unsterilised soil with sterilised or unsterilised flax seeds as food, sterilised seeds proved superior to unsterilised ones, but the results with the latter were improved by unsterilised soil [*cf. R.A.E.*, A **47** 131].

Davis (G. R. F.). **Effects of dry and germinating wheat on feeding behaviour and growth of larvae of the prairie grain wireworm,** *Ctenicera aeripennis destructor* **(Brown) (Coleoptera: Elateridae).**—*Ent. exp. appl.* **2** no. 4 pp. 300–303, 7 refs. Amsterdam, 1959. (With a summary in French.)

The following is based on the author's summary. When larvae of *Ctenicera aeripennis destructor* (Brown) start to feed on dry or germinating wheat, they take as much food, and a similar proportion of embryo and endosperm, at each feeding. However, they feed twice as frequently on germinating wheat as on dry wheat, and therefore consume twice as much of the former as of the latter. It is suggested that an olfactory attractant may diffuse out from germinating wheat. The larvae gained as much weight on embryo or endosperm as on whole kernels of germinating wheat. The gain in weight on each of these foods was significantly greater than on hard seeds, and 44 per cent. of those provided with whole dry seeds, 22 per cent. with whole germinating seeds, 26 per cent. with endosperm and 18 per cent. with embryo of germinating wheat moulted during the 28-day period. No diapause occurred in larvae fed only on endosperm of germinating wheat for 80 days [*cf. R.A.E.*, A **47** 91].

Umbreit (W. W.). Ed. **Advances in applied microbiology. Volume 1.**—$9\frac{1}{4} \times 6$ in., xi + 304 pp., illus., many refs. New York, N.Y. & London, Academic Press, Inc., 1959. Price $9.50.

The papers in this first volume of a proposed series comprising critical reviews of research in microbiology include one on insect microbiology, by S. R. Dutky (pp. 175–200, 2 pp. refs.), who summarises knowledge of the bacteria, fungi, Protozoa, rickettsiae, viruses and nematodes that are pathogenic for insects and the uses that have been made of them for the control of crop pests.

Report of the Seventh Commonwealth Entomological Conference 6th–15th July 1960.—iii + 399 pp., 18 figs., refs. London, Commonw. Inst. Ent., 1960. Price £2 10*s*.

In addition to an account of the Seventh Commonwealth Entomological Conference, which was held in London in July 1960, with the resolutions passed by it, this report includes five appendices. The first two of these (pp. 12–19 and 20–27) are memoranda on the work of the Commonwealth Institute of Entomology from 1st April 1954 to 31st March 1960 and on the organisation and work of the Commonwealth Institute of Biological Control, and the third (pp. 28–33) contains the proceedings of a general committee of the conference and of a sub-committee appointed to consider the work of the Commonwealth Institute of Biological Control. The fourth (pp. 34–195) comprises the text of the papers read at the scientific (open) meetings and reports of the discussions on them, and the fifth (pp. 196–399) contains a series of reviews of work on economic entomology in various parts of the Commonwealth during 1954–59 that were presented to the conference.

The territories (or organisations) from which these reviews were received and the pages occupied by them are as follows: Aden (pp. 198–201, 1 ref.); Australia (with the Territory of Papua and New Guinea) (pp. 202–210); Barbados (pp. 211–213, 4 refs.); British Guiana (pp. 214–215); British Solomon Islands (pp. 216–218, 5 refs.); Canada (Research common to agriculture and forestry, pp. 219–223; Agricultural entomology, pp. 223–234; Forest entomology, pp. 235–241); Ceylon (Tea Research Institute, pp. 242–243, 7 refs.); East Africa High Commission (Forest entomology, pp. 244–245, 2 refs.; East African Trypanosomiasis Research Organization, pp. 246–252, 44 refs.; East African Veterinary Research Organization, pp. 253–254); Federation of Malaya (Department of Agriculture, pp. 255–256, 2 refs.; Forest Research Institute, pp. 256–258; Rubber Research Institute, pp. 258–259, 1 ref.; Institute for Medical Research, pp. 259–260, 18 refs.); Federation of Nigeria (Ministry of Economic Development, pp. 261–265; Malaria Service, pp. 265–266, 11 refs.); Federation of Rhodesia and Nyasaland (Ministry of Agriculture, agricultural pests in Northern and Southern Rhodesia, pp. 267–271; Cotton Pest Research Scheme (all three territories), pp. 271–273, 6 refs.; Tobacco Research Board (Southern Rhodesia), pp. 274–275); Fiji (pp. 276–278); Ghana (Ministry of Agriculture, pp. 279–282, 2 refs.; Cocoa Marketing Board, pp. 282–284); Great Britain (pp. 285–295); Jamaica (Entomology Division, pp. 296–297); Kenya (Department of Agriculture, pp. 298–303, 12 refs.; Forest Department, pp. 303–304; Tsetse and trypanosomiasis control, pp. 304–309, 1 map, 13 refs.); Mauritius (pp. 310–312, 6 refs.); New Zealand (pp. 313–324); Northern Nigeria (Agricultural entomology, pp. 325–328; Veterinary Tsetse Control Unit, pp. 328–331, 6 refs.; Ministry of Health, pp. 331–334, 9 refs.); Northern Rhodesia (Tsetse control, pp. 335–340); Nyasaland (Agricultural entomology, p. 341; Tsetse flies, p. 342); Seychelles (pp. 343–344, 2 refs.); Southern Rhodesia (Tsetse

flies, pp. 345–346); Tanganyika (pp. 347–349); Trinidad (Agricultural entomology, pp. 350–351; Biological control, pp. 351–352); Uganda (pp. 353–360, 12 refs.); Union of South Africa (pp. 361–384, 9 refs.); West African Cocoa Research Institute, Ghana, and its Nigerian sub-station (pp. 385–391); West African Institute for Trypanosomiasis Research, Nigeria (pp. 391–394, 13 refs.); West African Stored Products Research Unit, Nigeria (pp. 394–396, 8 refs.); West Indies (Imperial College of Tropical Agriculture, Trinidad, pp. 397–398); and Zanzibar (p. 399).

The papers read at the open meetings and published, with the discussions on them, in Appendix IV were: Recent developments in insecticides for crop protection, pp. 35–42, 4 refs., by J. T. Martin; Problems in the use of insecticides, pp. 45–49, 19 refs., by A. B. Hadaway; Hazards from using pesticides, pp. 51–52, by J. M. Barnes; The safe use of pesticides in the United Kingdom, pp. 52–54, by E. J. Miller; The organisation of stored products work within the Commonwealth, pp. 55–61, 4 figs., by D. W. Hall; Stored products pests and international trade, pp. 61–68, 1 graph, 15 refs., by J. A. Freeman; Some practical problems in the use of contact insecticides against stored-product insects, pp. 68–71, 10 refs., by E. A. Parkin & A. A. Green; The future of biological control, pp. 72–79, 18 refs., by F. Wilson; Resistance of host varieties to the wheat stem sawfly, *Cephus cinctus* Nort. (Hymenoptera: Cephidae), pp. 81–84, 14 refs., by N. D. Holmes; The water status of the host plant in relation to attack by sucking insects in the humid tropics, pp. 84–86, 7 refs., by R. G. Fennah; Ambrosia beetle research in West Africa, pp. 88–97, 8 refs., by T. Jones; The susceptibility of hardwoods to *Lyctus* powder-post beetles and methods of control, pp. 97–102, 59 refs., by J. D. Bletchly; Observations on the termites which damage constructional timbers, pp. 103–106, 2 refs., by W. V. Harris; Termite control in West African afforestation, pp. 106–108, by W. A. Sands; Some factors in the use of pathogens in biological control with special reference to viruses, pp. 111–118, 20 refs., by K. M. Smith; A virus disease in the biological control of the wattle bagworm [*Kotochalia junodi* (Heyl.) on *Acacia mollissima* in South Africa], pp. 118–122, 8 refs., by L. L. J. Ossowski; Recent advances in tsetse and trypanosomiasis research and reclamation, pp. 125–128, by J. Ford; The control of tsetse flies with insecticides, pp. 128–131, 13 refs., by K. S. Hocking; The fluctuating distributions of the desert locust [*Schistocerca gregaria* (Forsk.)] in relation to the strategy of control, pp. 132–140, 10 maps, 2 graphs, 22 refs., by Z. V. Waloff; The present position in the study of insect dispersal and migration, pp. 140–145, 14 refs., by C. G. Johnson; Physiology and behaviour [of locusts], pp. 146–152, 20 refs., by P. T. Haskell; Operational research [on locusts], pp. 152–156, 11 refs., by R. C. Rainey; The ways in which plant viruses are transmitted by vectors, pp. 157–161, 12 refs., by M. A. Watson; Some aspects of virus spread among plants by vectors, pp. 162–165, 32 refs., by A. F. Posnette; The behavioural fitness of aphids as field vectors of viruses, pp. 165–168, by J. S. Kennedy; Control by insecticides of the spread of plant viruses, pp. 168–170, by L. Broadbent; The links between research and the grower in the field of plant protection in Canada, pp. 172–180, 10 refs., by A. P Arnason; The links between research and advisory work in England and Wales, pp. 180–184, 3 refs., by F. H. Jacob; The link between research and application of crop protection chemicals from the manufacturer's point of view, pp. 184–187, by G. Watts-Padwick; Plant protection research and its application under the diverse agricultural conditions of Kenya Colony, pp. 187–190, by A. R. Melville; and Problems of plant protection extension among peasant farmers in West Africa, pp. 190–195, by F. A. Squire. The rest of the appendix contains reports of the discussions on these papers.

Bigger (M.). *Selenothrips rubrocinctus* (**Giard**) **and the floral biology of cashew in Tanganyika.**—*E. Afr. agric. J.* **25** no. 4 pp. 229–234, 4 figs., 2 refs. Nairobi, 1960.

Selenothrips rubrocinctus (Giard) is a less important pest of cashew (*Anacardium occidentale*) in Tanganyika than are the Mirids, *Helopeltis bergrothi* Reut. and *H. anacardii* Miller [*cf. R.A.E.*, A **47** 170], since it is usually confined to small groups of trees, but the loss of crop caused to these is considerable. The thrips feed on the leaves, and observations on their effect on trees three years old were made in 1958. The following is based on the author's summary of the results.

Inflorescence counts showed that the trees attacked were producing more flowers than those unattacked, but it was later found that the yields were lower. The trees flowered in July–December, reaching a maximum in mid-September, from which time to the beginning of December 90 per cent. of the yield was produced. Attack by the thrips resulted in a loss of 259 lb. nuts per acre, the infested trees producing 378 lb. and the uninfested 637 lb. per acre. Infestation did not seriously alter the time of development of the inflorescence, and, though the number of male flowers was drastically reduced, the perfect flowers remained at about the same level. However, pollination seemed to be affected, as the set of nuts was reduced from 10·2 per cent. of the perfect flowers to 3·8 per cent. and the percentage of panicles producing mature nuts from 93 to 71.

Prevett (P. F.). **An investigation into storage problems of rice in Sierra Leone.**—*Colon. Res. Stud.* no. 28, iii + 52 pp., 4 pls., 13 figs., 20 refs., multigraph. London, Colon. Off., H.M.S.O., 1959.

The infestation of stored rice by insect pests in Sierra Leone was investigated in 1954–58, and this report of the work contains an account of observations on methods of storage and control, some of which have already been noticed [*R.A.E.*, A **48** 168], together with information on the rice-producing areas of the Colony, the methods of processing and storage in use, the place of origin and intensity of infestation (with the insects responsible) of imported rice and, in an appendix, lists of injurious insects and mites and of beneficial insects recorded from rice and other stored products during the period, with the commodity with which they were associated and, for some, the place of origin. Of the insects introduced with imported rice, *Trogoderma granarium* Everts from Burma was the most important, though observations indicated that it is unlikely to become a serious pest. Coleoptera recorded from Sierra Leone for the first time include *Sitophilus* (*Calandra*) *granarius* (L.) in raw rice from Italy and *Thorictodes heydeni* Rttr., which became the dominant secondary pest of parboiled paddy in February–May 1956 and was also found in parboiled rice from Burma; *Palorus mahenus* Gebien, of which one example was found in raw rice from Italy, was not hitherto known in stored products.

The following is based largely on the author's summary and recommendations. Field observations showed that *Sitotroga cerealella* (Ol.) and a species of *Sitophilus* (*Calandra*) with large, dark adults, probably representing *S.* (*C.*) *oryzae* (L.) [*cf.* **46** 208], can both infest rice in the field, either before harvest or during drying prior to threshing, but that only *Sitotroga* can thereafter continue to breed in good-quality paddy. It is stated in a footnote that specimens of *Sitophilus* collected in Freetown in May 1959 were identified as *S.* (*C.*) *sasakii* (Tak.) (formerly considered a small strain of *S. oryzae* [*cf.* **48** 130, etc.]) on milled rice and *S. oryzae* on raw paddy; the laboratory stocks used in the investigations recorded below [*cf.* also **48**

168] were raised from adults from Freetown that were small and light in colour and were probably *S. sasakii*. From large-scale experiments in 1955–56 on the storage of paddy in bags and in bulk and the bulk storage of native-cleaned rice, it is concluded that raw paddy with a moisture content of 13–15·6 per cent. can safely be stored in bags for a year. The apparent percentage loss in parboiled paddy stored in bags for one year was 12·3 for a stack of 225 bags and 25·5 for 12 bags; in the latter case, the actual loss was 41 per cent. Parboiled paddy stored for eight months in a plywood silo became heavily infested only at the surface and suffered a loss of only 3·4 per cent. In all cases, the major pest was *Rhyzopertha dominica* (F.). It is concluded, therefore, that bulk storage of paddy is preferable to bag storage.

Field and laboratory experiments on the rate of increase of insect populations in stored rice and the susceptibility of different types of rice to attack by insects were also carried out in 1955–56. *R. dominica* increased very rapidly during the first six months of storage of twelve 150-lb. bags of parboiled paddy. In laboratory experiments, it infested swamp and upland raw paddies and parboiled milled rice to a limited extent, and native-cleaned rice to a greater extent, parboiled paddy providing optimum conditions for its development. *S. sasakii* was unable to live or breed on the two types of raw paddy tested [*cf.* **49** 6], and bred at a higher rate on native-cleaned rice and parboiled milled rice than on parboiled paddy. *Corcyra cephalonica* (Stnt.) and *Tribolium castaneum* (Hbst.) developed only in native-cleaned rice and parboiled milled rice, which, however, appeared not to be very satisfactory media; *S. granarius* bred in parboiled paddy, and a culture was maintained on parboiled milled rice, but it did not survive or breed in raw paddy. An experiment to determine the effect of relative humidity, and therefore grain moisture-content, on the development of rice pests indicated that *Rhyzopertha* bred at a high rate at moisture contents of 10–14·5 per cent., the optimum being about 12 per cent., and that *S. sasakii* bred on rice at moisture contents of 11·4–15 per cent., with an optimum at 15 per cent.

The control measures at present employed for stored rice are outlined. The infestation in Sierra Leone of imported rice by *T. castaneum* and *Oryzaephilus* spp. constitutes the major problem and has arisen largely through the widespread use of γ BHC (lindane), to which they are not susceptible. A large-scale experiment to compare γ BHC and malathion for the protection of parboiled paddy in bags against *Rhyzopertha* showed that admixture of γ BHC with the paddy at 5 parts per million was more effective than monthly applications of either lindane or malathion dust to the outside of the bags and that admixture of γ BHC combined with external application was the most effective treatment; a test indicated that malathion is more persistent than γ BHC. Several trial fumigations with a 1:3 mixture of carbon tetrachloride and ethylene dichloride were carried out; in one, 54 tons of imported rice infested by *T. castaneum* and *Oryzaephilus* spp. was successfully fumigated under gas-proof sheeting.

On the basis of the work, it is recommended that rice for long-term storage should be in the form of raw paddy. Raw or parboiled paddy that is to be kept for more than a few months should be stored in bulk, to permit the control of initial infestation by fumigation, and γ BHC dust should be mixed with the surface layer, especially in the case of parboiled paddy. The same dust should be mixed with paddy stored in bags and the bags dusted with 1 per cent. malathion or sprayed with wettable malathion or a combination of 8 oz. 50 per cent. wettable DDT and 6 oz. 25 per cent. wettable γ BHC per gal. per 1,000 sq. ft. surface at monthly intervals; storage should be in premises with smooth inside walls, waterproofed floor, controlled ventilation and dimensions that permit the construction of small

stacks, so that regular inspection and, where needed, fumigation under gas-proof sheeting can be carried out. Used bags should be treated with an insecticide and stored apart from the rice. Stacks of rice should be treated monthly and also before fumigation, and the fabric of storage premises whenever empty and at three-monthly intervals, with the combined spray of DDT and γ BHC or with wettable malathion; the latter spray is recommended for non-alkaline surfaces. Other measures comprise the practice of strict storage hygiene, the provision of increased facilities for both storage and fumigation, and the inspection and, where necessary, prompt treatment of imported commodities.

Meeting of specialists on stored food products . . . Salisbury 1957.—*Publ. sci. Coun. Afr. S. Sahara* no. 31, 200 pp., 3 graphs, refs. [London] 1958.

The papers here published were read at a conference in Southern Rhodesia, at which problems relating to the protection of stored foodstuffs from insect and other pests in Africa south of the Sahara were discussed. The subjects dealt with include the organisation of and legislation and regulations relating to control, the assessment of losses caused by infestation, and storage and other techniques of use in control. The following papers, and some containing information already noticed [*cf. R.A.E.*, A **40** 265; **41** 66; **44** 4; **45** 294; **46** 212; **48** 434, 435; and preceding abstract], deal with the pests present in various territories or with work on their bionomics and control.

Salmond (K. F.). **Studies on *Trogoderma granarium* Everts (Dermestidae—Coleoptera). I. Its importance as a pest of stored maize in the Federation of Rhodesia and Nyasaland** (pp. 35–49, 3 graphs, 11 refs.). *Trogoderma granarium* Everts, which occurs in Nyasaland [**47** 235] and was found infesting stored maize in Northern Rhodesia in 1954–55 [*cf.* **44** 27; **45** 370], has become established in the latter, principally in storehouses along the railway. The factors responsible for its multiplication and spread in both Northern and Southern Rhodesia, where the position is similar, are discussed, and it is stated that the loss of weight in individual bags of maize that were heavily infested after storage for nearly two years ranged from 12 to 19 per cent. after screening. Suggested long-term measures to be applied over a period of three years include inspection to discover infested premises, which should be placed in quarantine where practicable and, with infested trucks, be cleaned and sprayed repeatedly with malathion or a similar insecticide, and fumigation with methyl bromide of all infested maize and other products, of used empty sacks, and of cereals and cereal products imported from South Africa, where the Dermestid is present [**46** 407]; it also occurs in Zanzibar. **II. Numbers, distribution and activity of *Trogoderma granarium* in the fabric of a Cape-steel storage shed** (pp. 51–57, 3 refs.). *T. granarium* was by far the commonest insect found in 1957 in the fabric of a large shed with a steel framework and asbestos roof and walls (three with brick and concrete bases) on a concrete base covered inside with Ruberoid felt, containing heavily infested maize placed there in 1954. Larvae and adults were abundant in daylight on the outside of the walls; outside the shed, the larvae were most numerous in the concrete base and, to a less extent, in the wall bases and, inside it, in the wall bases (where they were not apparent until the bricks were scraped), at the junction of the floor and wall edge, and under the edge of the floor covering. The larvae, with other insects, were exceptionally numerous on girders at ground level at the south end of the shed. Although the counts inside the shed were made after the maize had been fumigated with methyl bromide at 3·5 lb.

per 1,000 cu. ft. for 48 hours, most of the larvae of *Trogoderma* and half the adults of *Tribolium* spp. from the wall bases and most of the *Trogoderma* adults from the walls were alive. It is therefore recommended that the fabric of storage sheds, both inside and out and especially walls, ledges and girders, should be cleaned and then sprayed with 25 per cent. wettable malathion at 8 oz. in 1 gal. water per 1,000 sq. ft. of exposed surface, before the gas sheets are removed from fumigated commodities.

Forsyth (J.). **Maize storage in Ashanti** (pp. 71–76). Farmers in Ashanti, Ghana, produce two crops of maize a year, which they store, usually in the sheath, in wooden cribs. At harvest, the grain has a high moisture content and though it dries out during storage, severe infestations develop in it. *Sitophilus* (*Calandra*) *oryzae* (L.) is the principal pest, but *Mussidia nigrivenella* Rag. is common and widespread. Of cobs harvested in July 1955, a third were infested by *S. oryzae*, rather more by *Palorus* spp., and the rest by Lepidopterous larvae, including *M. nigrivenella*. The evidence indicated that *Palorus* attacked damaged grains. Continued emergence of adults of *S. oryzae* caused apparent infestation, assessed as exit holes, in newly harvested cobs put in cribs on 2nd September 1956 and dusted with 0·45 per cent. γ BHC at 4 oz. per cwt. to increase from less than 2 to 4·2 per cent. in 11 weeks, whereas in untreated maize continued breeding caused increases to 16·6 and 29·4 per cent. Drying and dusting maize in sacks [*cf.* **48** 556] and subsequently storing it in a plywood silo gave satisfactory results at an agricultural station in 1954 and, following a successful trial by farmers in one village in 1955, was adopted in other villages in 1956 and more generally in 1957.

Whellan (J. A.). **Current problems in grain storage in Southern Rhodesia** (pp. 77–82). Following the discovery of *Trogoderma granarium* Everts infesting screenings in Southern Rhodesia in September 1955, a neighbouring silo was fumigated with methyl bromide before being filled with newly harvested maize [*cf.* **45** 371], but owing to leakage from some of the bins during fumigation, heavy infestations by *T. granarium* and other insects had built up undetected by December. During 1956, *T. granarium* was inadvertently distributed on railway trucks and in meal or screenings to other centres, where heavy infestations developed, and the Dermestid eventually outnumbered other grain pests. Inadequate fumigation facilities hindered control, but it is anticipated that measures applied on farms and at intermediate storage premises will eventually be adequate. Spraying the walls of storage sheds, each layer of bags as they are stacked and the completed stack with a combination of 8 oz. 50 per cent. wettable DDT and 8 oz. 25 per cent. wettable malathion in 1 gal. water per 1,000 sq. ft. is recommended. A stack so treated and then fumigated with methyl bromide under gas sheets contained no detectable infestation over three months later. A list of insects that infest grain and meal, pulses and groundnut cake in Southern Rhodesia is appended.

Smit (B.), Nolte (C.) & Brunnekreeft (F.). **The fumigation of railway grain elevators for maize insects** (pp. 83–96). In South Africa, railway grain elevators have had to be used for storage of maize, although not designed for the purpose and with no provision for insect control. In consequence, infestations heavier than any yet recorded have developed. An attempt, which is described, to fumigate an elevator, 90 ft. high and equipped with a dust-extraction plant, with methyl bromide vaporised with compressed air gave complete mortality only at depths of 50 ft. or more from the grain surface, and significant kill only below a level of 6·5 ft. The mixture of air and methyl bromide diffused through the grain in all directions, but the bromide sank too quickly to give satisfactory mortality near the top.

Le Pelley (R.) & Kockum (S.). **The control of stored products insects in Kenya** (pp. 107–115). Of the work in Kenya described in this paper, some was still in progress and some has already been noticed from other sources [**42** 251; **44** 68; **47** 97]. Maize mixed with a dust containing 1 part pyrethrins with 16 parts piperonyl butoxide at 3·8 parts pyrethrins per million prior to storage in bags was protected from insect attack for over 15 months, and a mixture in which the insecticide : synergist ratio was 1 : 10 was outstandingly effective for over 19 months at 3·75 p.p.m. pyrethrins. Fumigation of bagged maize under gas-proof sheets with methyl bromide at 2 lb. per 1,000 cu. ft. for 48 hours eradicated *Sitophilus* (*Calandra*) *oryzae* (L.), but small numbers of *Tribolium castaneum* (Hbst.) and *Oryzaephilus surinamensis* (L.) survived. Railway trucks sprayed with 18 per cent. dieldrin combined with 1·8 per cent. coumarone resin remained free from infestation for a year. In tests of spray treatments for the walls of stores, one of urea formaldehyde resin containing 2 per cent. BHC and 20 per cent. DDT applied to whitewashed rough stone walls remained fully effective against both *S. oryzae* and *T. castaneum* for five months and probably for up to ten or more; a similar spray containing 5 per cent. BHC and 10 per cent. DDT was effective against *S. oryzae* after five months, but did not give complete kill of *Tribolium*.

Coquard (J.). **Traitement au four infra rouge des semences de maïs envahies par** *Sitophilus oryzae* **L.** (p. 131–134, 3 refs.). Exposure of seed maize infested by *Sitophilus oryzae* (L.) to heat induced by infra-red irradiation [*cf.* **41** 233; **45** 252] for 3 min. 10 sec. did not impair germination and gave virtually complete mortality of the adults and larvae when the amount of electric energy received was 3·28 joules and complete kill when it was 3·78 joules. Exposure to 8 joules for the same period was necessary for the destruction of the eggs, however, and since this treatment affects germination, it cannot be used for seed maize, though it will destroy all stages in maize for consumption.

Decelle (J.). **Liste des insectes des denrées trouvés au Congo belge** (pp. 161–163). This is a systematic list of insects that attack stored foodstuffs in the Belgian Congo, followed by notes on the more important pests of the individual commodities.

Appert (J.). **Protection de l'arachide au Sénégal contre les insectes nuisibles** (pp. 173–176, with a summary in English). *Caryedon fuscus* (Goeze) and the Lygaeids, *Aphanus sordidus* (F.), *A. apicalis* (Dall.), *Dieuches armipes* (F.) and *D. patruelis* (Stål.), are the only pests of stored groundnuts that are sufficiently injurious in Senegal to warrant control measures, and the information here given on *Caryedon* has already been noticed [**45** 492]. Feeding by the Lygaeids causes the groundnuts to shrivel and become empty, impairs their flavour, and in three months can reduce viability by up to 50 per cent. The females oviposit seven days after becoming adult, and lay 100–200 eggs each, in batches of about six, in damp sand; incubation occupies 5–10 days. Groundnuts in warehouses are not attacked, and those stored in heaps in the open can be protected by incorporating lime or BHC into the soil on which they are to be placed and, each evening, dusting the surface and base of the heaps with BHC or trapping the adults in damp straw, which is destroyed the next morning.

Mallamaire (A.). **Catalogue des principaux insectes nuisibles aux denrées alimentaires emmagasinées en Afrique occidentale française** (pp. 181–187, with a summary in English). This is a systematic list of insects that attack stored foodstuffs in French West Africa [*cf.* also **44** 341]; the importance of the damage and the commodity attacked are indicated for most species and information on bionomics is included for some.

Schmitz (G.) & Blomme (A.). **Un moyen de lutte contre le charançon du bananier: le trempage-pralinage.**—*Bull. INEAC* **8** no. 3 pp. 177–188, 4 figs., 2 refs. Brussels, 1959.

Banana in the Uele district of the Belgian Congo is being increasingly infested by *Cosmopolites sordidus* (Germ.), and planting-material free from the weevil is difficult to obtain. Protective measures are more effective than control by poison baits or dusts, but the application of dusts to the planting holes does not protect above the root collar. Dusting the planting material itself is wasteful, and tests were therefore begun in 1955 on the value of dipping the young plants in insecticide before planting. Slurries were preferred to simple suspensions or solutions, since the coating round the plant affords more permanent protection. The plants were dipped up to the level of the leaves and dried for 24 hours before planting, and it was found that, of the insecticides tested, endrin gave the best results. About 250–300 cc. slurry containing 0·28 cc. actual endrin in emulsion concentrate was needed per plant, and a fertiliser was used with it in some series. It resulted in the best plant survival (80 per cent. or more after 12–14 months), growth and yield and afforded almost complete protection of surviving plants for up to two years.

Cachan (P.). **Étude épidémiologique de la zygène** (*Chalconicles catori* **Jordan**) **des cocotiers et des palmiers à huile en Côte d'Ivoire.**—*J. Agric. trop. Bot. appl.* **6** no. 12 pp. 653–674, 2 pls., 6 figs., 5 refs. Paris, 1959.

Studies on the Zygaenid, *Chalconycles catori* Jordan, all stages of which are described, were begun in 1957 in the Ivory Coast, where it causes considerable injury to coconut by feeding on the leaves. The egg, larval and pupal stages lasted 6–13, 22–33 and 10–14 days, respectively, and the adults paired soon after emerging and lived for only a few days. Coconut is assumed to be a secondary food-plant, as attack on it is always accompanied by infestation of oil palm [*Elaeis guineënsis*]. On coconut, the infestation was particularly heavy on trees over 15 years old near the sea, and older trees further inland were free from attack. Since the adult flies only very short distances, infestation does not spread over small natural barriers. Heavy rain and a drop in temperature appeared to prevent activity. The distribution of the pest over the palm according to the age of the leaves is described. In control tests, DDT was applied at 0·037 per cent. in sprays from aircraft to oil palms, and it gave good results against older larvae (up to 99 per cent. kill) and pupae (up to 100 per cent.), but was virtually ineffective against the eggs. Treatment is necessary only in July–October, after the rains and while the population is rising; there is a rapid natural decline in numbers after this period.

Surany (P.). **Diseases and biological control in rhinoceros beetles** *Oryctes* **spp. (Scarabaeidae, Coleoptera).**—*Tech. Pap. S. Pacif. Comm.* no. 128, vi+62 pp., 100 figs., 7 pp. refs. Noumea, 1960. (With a summary in French.)

The first two sections of this paper comprise reviews of the economic importance, ecology and control of *Oryctes* spp. with special reference to coconut palms, on which the main species are *O. rhinoceros* (L.) in south-eastern Asia and the Pacific islands [*cf. R.A.E.*, A **42** 103; **46** 157] and *O. monoceros* (Ol.) in East Africa. The third is a summary of previous knowledge on the pathology of *O. rhinoceros* [*cf.* **46** 158; **47** 18]. As this subject had been comparatively little studied with a view to control, a

project was inaugurated by the South Pacific Commission in 1955 in the form of a survey of *Oryctes* populations in south-eastern Asia and East Africa. The procedures adopted are described in the fourth section, and the results are recorded in the fifth and compared with those obtained with other Lamellicorns.

Two diseases were of chief importance, one referred to as Heidenreich's disease, because of its similarity to a ' dropsy ' (Wassersucht) of *Melolontha* spp. in Germany first recorded by that author [**33** 7; *cf.* also **46** 290; **48** 82], and the other termed Maya's disease, because of Maya's record in 1912 of similar symptoms in *Clemora smithi* (Arr.) in Mauritius. The first affects the larvae and was found most commonly in *O. rhinoceros* in Medan, Sumatra, and *O. monoceros* in Pemba Island, Zanzibar. It may be of virus origin and transmitted through the egg. The second affects the larvae, pupae and adults and was found in various species of *Oryctes*, including *O. monoceros* in African territories and *O. rhinoceros* in Ceylon. Its aetiology is unknown, but it appeared not to be rickettsial. The symptoms of these two diseases, which often occurred in the same insect, are described; both were accompanied by crystal formation. In addition to these diseases, various pathological tissue formations were noted in *Oryctes* spp., including one in Madagascar and the Seychelles involving small cysts. Rickettsial and bacterial diseases were unimportant, but entomophagous fungi of the genus *Metarrhizium* were fairly common, sometimes occurring in conjunction with other pathogens. Nematodes were common in Africa but rare in Asia, and unidentified mites, which were often found associated with various stages of *Oryctes*, caused considerable mortality of eggs and newly hatched larvae.

The final section comprises an evaluation of the findings. It is concluded from them that diseases are responsible for up to 90 per cent. mortality of *Oryctes* spp. in various stages of development and capable in combination of affording biological control.

Wilson (F.) & Snowball (G. J.). **Some effects of temperature on the diurnal periodicity of adult emergence in** *Trichopoda pennipes* **(Diptera: Tachinidae).**—*Aust. J. Zool.* **7** no. 1 pp. 1–6, 2 graphs, 6 refs. Melbourne, 1959.

Puparia of *Trichopoda pennipes* (F.) were received in Australia from Florida and the West Indies for use against *Nezara viridula smaragdula* (F.) in 1952 and 1953. The adults of this Tachinid mostly emerge between sunrise and midday, but experiments showed that this periodicity is greatly modified by temperature changes, and adults can be induced to emerge at any time by providing a temperature-increase stimulus. Adults sometimes emerge in response to very small increases of temperature; in one case, a rise of only 0·5°C. [0·9°F.] sufficed.

Key (K. H. L.) & Common (I. F. B.). **Observations on the ecology of the clothes moths** *Tineola bisselliella* **(Humm.) and** *Tinea pellionella* **L. in a bulk wool store.**—*Aust. J. Zool.* **7** no. 1 pp. 39–77, 3 pls., 8 figs., 21 refs. Melbourne, 1959.

The following is almost entirely the authors' summary. Observations on the behaviour and abundance of *Tineola bisselliella* (Humm.) and *Tinea pellionella* (L.) were made during 1942 and 1943 in a wool store in Brisbane, Queensland, that remained relatively undisturbed for more than three years. The store contained about 10,000 jute-covered ' double dumps ' (two bales placed head to head, compressed under a pressure of 800 lb. per sq. in.

and secured by four steel bands) of low-grade, greasy wool, stacked in large bays separated by passages. Microclimatic conditions were more equable than in the open and very favourable to the moths. Substantial vertical gradients in temperature and relative humidity resulted from insolation of the roof, but there was little horizontal differentiation. The wool tended to buffer fluctuations of these elements, both in the free air spaces and, still more, within the dumps.

Larvae of *Tinea* were confined to loose wool protruding through breaches in the jute packing. *Tineola* occurred both there and within the superficial two inches of the compressed wool. By 1943, there was estimated to be an average of about 50 well-grown larvae per dump. Adults could always be seen at rest or running on the dumps throughout the stacks. The moth populations were studied by sampling with adhesive traps in the passages and stacks. Both species had a flight period at about dusk, about half the 24-hour catch being made during the three hours after sunset. The peak occurred earlier on cool evenings. A regression of activity on mean flight-period temperature was established, a rise from 65 to 80°F. doubling the catch. Females rarely fly; they normally constituted only about 0·3 per cent. of the catch, although the ratio of males to females in the population as a whole was probably 2:1 for *Tineola* and 1:4 for *Tinea*. The density of moths in flight was approximately equal in stacks and passages at a given level, but usually increased with height. By correcting the daily catches for the effect of temperature on activity, plots of adult abundance against time were constructed. The two species fluctuated in almost identical fashion. Numbers were low in winter and high in spring and summer, with an indication of 2–3 generations a year. From the beginning of 1943, a great decline in abundance set in, the peak for that year being a small fraction of that for 1942.

The Braconid, *Apanteles carpatus* (Say), a parasite of both moths, was also taken on the traps. It had a flight period at about the time of the daily temperature maximum. A regression of activity on temperature showed a near-quadrupling of the catch for a rise from 70 to 85°F. A plot of adult abundance was derived as for the moths. It showed a single seasonal peak occurring after the moth peaks. Several overlapping generations are postulated. The abundance ratio of *Apanteles* to moths rose steadily from spring to autumn in each year, but showed close agreement for corresponding seasons of the two years; there is no reason to ascribe the 1943 decline in moth numbers to the parasite. A spider, *Uloborus geniculatus* (Ol.), became very abundant during 1943 and is believed to have been responsible for the decline of the moths, which represented its main source of food. Over the relevant period, the percentage of female moths in the catch increased 40-fold, presumably as a result of the differential removal of the active males by the spider. It is calculated that in this way the number of males was reduced by November 1943 to about 1/45th of what it would otherwise have been. The spider probably also caught adults of *Apanteles*. It is concluded that, apart from effects of the introduction of additional species, the moths and spiders would ultimately establish some sort of equilibrium, probably at a rather low level of density. The factors favouring *Uloborus* in its limiting rôle are discussed.

DE ONG (E. R.). **Chemical and natural control of pests.**—$9\frac{1}{4} \times 6$ in., viii + 244 pp., 12 figs., many refs. New York, N.Y., Reinhold Publ. Corp.; London, Chapman & Hall, Ltd., 1960. Price £3.

This book was written to assist in the evaluation of biological factors and chemical treatment in the control of injurious arthropods and other pests,

with special reference to conditions in the United States. It is pointed out in the preface that natural factors alone seldom result in satisfactory control and must be supplemented by chemical treatments, but excessive use of the latter may have unfavourable effects. The book consists of an introduction, including a review of the economic importance of insects, whether as pests or as destroyers of weeds or débris, and the various agents of natural control, followed by two main parts. The first of these, on natural control, comprises chapters on insect parasites and predators, biological control and the effects of insecticides on natural enemies; diseases of insects; and insect- and disease-resistant plants. The second, which occupies about three-quarters of the book, is devoted to chemical control and contains chapters on the various uses of chemicals against pests and the control of insects, diseases and weeds affecting field crops, orchards, vineyards, vegetables, ornamental plants and lawns; insects, mites and ticks infesting livestock; household insects and rodents; and insects, diseases and rodents damaging stored products. An appendix shows the chemical names and uses of the toxicants mentioned in the main text, and there is an index to the whole.

Brazzel (J. R.). **The effect of late-season applications of insecticides on diapausing boll weevils.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1042–1045. 1 fig., 5 refs. Menasha, Wis., 1960.

The author describes field-cage experiments in Texas, in which insecticides were applied to cotton plants against *Anthonomus grandis* Boh. after the end of the normal control programme, to determine the effect of treatment during harvest, when the weevils were accumulating fat reserves in preparation for winter diapause [*cf. R.A.E.*, A **48** 459]. Toxaphene at 3 lb. and methyl-parathion at 0·5 lb. per acre were applied at intervals of 10–12 days from 22nd August to 20th November and calcium arsenate at 10 lb. more rarely during the same period, and dissections of weevils from treated and untreated cages showed that relatively large numbers entered diapause after treatment with toxaphene or calcium arsenate, but only one after treatment with methyl-parathion. It is concluded that this insecticide killed the weevils during the three weeks or more that elapsed after they left the squares and before they could enter diapause and so reduced the over-wintering population. Fewer applications would probably be adequate if effective defoliants or desiccants were used to destroy the food supply.

Andres (L. A.), Reynolds (H. T.) & Fukuto (T. R.). **The use of systemic insecticides for control of the cabbage aphid on cabbage and cauliflower.** —*J. econ. Ent.* **52** (1959) no. 6 pp. 1045–1050, 8 refs. Menasha, Wis., 1960.

The following is based mainly on the authors' abstract. Four systemic insecticides, phorate (Thimet), Di-Syston (O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate), demeton and demeton-S, were evaluated in the field for the control of *Brevicoryne brassicae* (L.), mainly on cabbage, in southern California in 1957–58. Seed-coat applications of the first two on activated charcoal at the rate of 4 lb. toxicant per 100 lb. seed caused a reduction in plant stand and gave moderate control of *Myzus persicae* (Sulz.) for as long as one month. When applied to the seed furrow at about 1 lb. per acre in granules, these materials and demeton-S controlled *B. brassicae* for 1–2 months, with no apparent reduction in the number of plants, and Di-Syston at about the same rate in a spray gave similar results. When applied in granules to the transplant furrow, Di-Syston at 1–2 lb. per acre gave good

control of a moderate population for at least two months, phorate at similar rates gave good initial kill but was not effective for so long and both materials at 0·5 lb. and demeton-S at 2 lb. gave early control but became ineffective after about a month or less. In solutions poured round the plants at transplanting, 4·4 lb. demeton and 8·8 lb. phorate or Di-Syston per acre gave excellent control for 50 days. When applied directly to infested foliage at 0·38 lb. per acre in granules, Di-Syston gave good control in five days and was still effective after 17; 0·69 lb. phorate was also effective, but lost its toxicity sooner. Residue tests indicated that, if applied at transplanting or soon after, phorate and Di-Syston almost entirely disappeared from the cabbage heads by harvest and that phorate broke down somewhat faster than Di-Syston.

Wolfe (H. R.), Elliott (J. W.) & Durham (W. F.). **The trend of DDT and parathion residues on apples grown in central Washington.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1053–1057, 12 refs. Menasha, Wis., 1960.

The following is substantially the authors' abstract. Tests were carried out in 1958 to determine the average amounts of DDT and parathion on apples sprayed for the control of pests in central Washington and to compare these residues with those found in past years when fewer and earlier sprays and lower dosages were used. Residues of DDT ranged from 0·3 to 12·4 parts per million, with a mean of 3 p.p.m. for all samples, both washed and unwashed, and showed an increase corresponding to an increase in the number of cover sprays applied. Washing reduced the residue, though little difference between washing with and without brushes was apparent; 15·2 per cent. of unwashed and 1·6 per cent. of washed samples had residues above the tolerance of 7 p.p.m. Parathion residues ranged from 0·01 to 0·32 p.p.m., with a mean of 0·1 p.p.m. The values for both materials were somewhat higher than those reported in earlier years.

McLean (D. L.). **Some aphid vector-plant virus relationships of the feathery mottle virus of sweet potato.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1057–1062, 23 refs. Menasha, Wis., 1960.

The following is substantially the author's abstract. A study of the relations between insect vectors and plant viruses was undertaken in California with an isolate of the feathery mottle virus of sweet potato [*cf. R.A.E.*, A **43** 275], termed the severe isolate, and *Myzus persicae* (Sulz.). The plants used were mostly *Ipomoea setosa*. The acquisition and inoculation threshold periods were found to be below five seconds and between five and ten seconds, respectively. Pre-acquisition starvation experiments showed that the efficiency of transmission was increased by five minutes of fasting, and post-acquisition starvation tests that, as fasting time increased, the efficiency of transmission decreased. The results of serial transmission tests on ten successive plants indicated that 38 of 50 aphids that had been starved and given short acquisition feeds were infective; they infected 115 of the 500 plants used. Analysis of the data by means of the binomial theorem supported the hypothesis that individual aphids were equally charged with virus, and artificial and natural interruptions in the acquisition feeds had no significant effect on transmission. In further tests, *Aphis apii* Theo. and *A. gossypii* Glov. also proved to be vectors of the virus, whereas aphids of six other species did not.

Krueger (H. R.) & O'Brien (R. D.). **Relationship between metabolism and differential toxicity of malathion in insects and mice.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1063–1067, 6 figs., 12 refs. Menasha, Wis., 1960.

The following is virtually the authors' abstract. An attempt was made to account for the selective toxicity of malathion on the basis of differences in its metabolism by various species. Eleven metabolites were found in *Blattella germanica* (L.), *Periplaneta americana* (L.) and *Musca domestica* L., and seven in mice. Most of the metabolites were identified. Degradation of malathion is much more extensive in mice than in insects, and malaoxon production is correspondingly lower; these effects account satisfactorily for the low toxicity of malathion to mice. The low toxicity of topically applied malathion to *B. germanica* is attributable to poor penetration through the integument.

Enkerlin S. (D.). **Different concentrations of Thiodan for the control of cotton insects.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1068–1069, 1 ref. Menasha, Wis., 1960.

Small-plot tests were carried out in Mexico in 1958 to compare Thiodan with the insecticides commonly used against insect pests of cotton. In one locality, 3–4 per cent. technical Thiodan with 40 per cent. sulphur was rather more effective than 1·5 per cent. methyl-parathion, 20 per cent. toxaphene or 2·5 per cent. dieldrin in dusts applied at about 25 lb. per acre, and 0·5 and 0·3 lb. technical Thiodan than 0·65 lb. methyl-parathion, 2 lb. toxaphene or 0·3 lb. endrin per acre in sprays, against fairly light infestations of *Psallus seriatus* (Reut.), *Heliothis zea* (Boddie) and *Trichoplusia ni* (Hb.), though differences were not always significant. In another district, the Thiodan dusts were significantly more effective against a severe infestation of *Anthonomus grandis* Boh. than a mixture of 3 per cent. BHC, 5 per cent. DDT and 40 per cent. sulphur, but mixtures of 20 per cent. toxaphene with 40 per cent. sulphur or 2·5 per cent. dieldrin with 10 per cent. DDT did not differ significantly from either; all treated plots had significantly fewer punctured squares than untreated ones.

Kazmaier (H. E.) & Fuller (R. G.). **Ethylene dibromide:methyl bromide mixtures as fumigants against the confused flour beetle.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1081–1085, 3 figs., 4 refs. Menasha, Wis., 1960.

In laboratory tests, *Tribolium confusum* Duv. was fumigated with ethylene dibromide, methyl bromide or mixtures of the two in ratios of 1:9–6:4 at 8, 10 or 12 mg. per litre for five hours at 74°F. Counts made 2 and 14 days after the treatment of larvae and adults and 14 days after the treatment of pupae showed that mixtures were more effective than methyl bromide alone, and counts of larvae and adults after one day that at 12 mg. per litre they were more effective than either component alone, indicating that they give a more rapid kill. Larvae hatched from eggs laid by adults surviving treatment with all dosages of methyl bromide and with mixtures giving a concentration of less than 1 mg. ethylene dibromide per litre, but not more. The doses tested gave complete mortality of eggs.

Dietrick (E. J.), Schlinger (E. I.) & van den Bosch (R.). **A new method for sampling arthropods using a suction collecting machine and modified Berlese funnel separator.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1085–1091, 3 figs., 4 refs. Menasha, Wis., 1960.

The authors describe a suction machine, in which a high-speed motor fan was adapted to draw arthropods, with some débris, from square-foot areas of a lucerne field into a collecting bag, without damaging them. The samples were refrigerated immediately, to prevent predation and other activity, and separated at the end of the day in a modified Berlese funnel, which trapped the organisms in alcohol. Three kinds of samples that can be taken with the machine are discussed, with their respective advantages and disadvantages, and it is shown that an almost complete quantitative sample of arthropods from the ground surface to the top of the plants can be taken quite quickly in a single operation, irrespective of environmental conditions. They can be separated by the funnels into easily counted units, in which the specimens are preserved.

Lindgren (D. L.) & Vincent (L. E.). **Sorption of single- and multiple-component fumigants by whole-kernel corn under recirculation, and correlated mortality of stored-product insects.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1091–1096, 3 figs., 2 refs. Menasha, Wis., 1960.

Gas chromatography was used to measure the sorption of various fumigants, used alone and in mixtures, by maize, and the results were correlated with mortality of adults of *Tribolium confusum* Duv. and *Sitophilus oryzae* (L.), exposed for 24 hours at 70°F. in the middle of the grain, in recirculating fumigation chambers.

The concentrations of single fumigants and of each component of the mixtures varied little during the exposure period in the empty chambers. In the presence of maize, the greatest reduction in concentration occurred during the first 15 minutes, indicating a very rapid rate of sorption by the grain. The initial drop in concentration was greater for acrylonitrile, ethylene dibromide and hydrogen cyanide than for carbon bisulphide, carbon tetrachloride or methyl bromide and intermediate for ethylene dichloride, whether the materials were used alone or in mixtures.

In the presence of a full load of maize containing 12–13 per cent. moisture, complete kill of *T. confusum* was given by dosages of at least 539 mg. carbon tetrachloride per litre, 283 mg. ethylene dichloride, 38·7 mg. hydrogen cyanide, and mixtures of 57 mg. carbon bisulphide with 287·3 mg. carbon tetrachloride, 212 mg. ethylene dichloride with 90 mg. carbon tetrachloride, and 108 mg. carbon tetrachloride with 49·5 mg. ethylene dichloride and 12·2 mg. ethylene dibromide, complete kill of *S. oryzae* by at least 13·5 mg. acrylonitrile, 142·2 mg. carbon bisulphide, 7·1 mg. methyl bromide and mixtures of 13·5 mg. acrylonitrile with 80·8 mg. carbon tetrachloride and 215·5 mg. carbon tetrachloride with 99·1 mg. ethylene dichloride and 24·4 mg. ethylene dibromide, and complete kill of both by 31 mg. chloropicrin.

Simmonds (F. J.). **Biological control—past, present and future.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1099–1102, 12 refs. Menasha, Wis., 1960.

The following is based on the author's abstract. The use of biological methods to control several injurious insects and weeds that had spread

from their original habitats has not exhausted the value of this technique; increasingly frequent and speedy air services have provided more possibilities for its use. The increasing rigidity of quarantine laws and inspection services has not prevented the accidental introduction of insects and weeds into new areas, since increased trade, and particularly the facility and speed of air transport, have more than offset their effect, and it is considered that the spread of injurious species into new areas will continue and afford additional opportunity for biological control.

The ecological approach to pest problems is suggested, in which an insect pest or its complex of natural enemies is considered not as an isolated entity, but in relation to the whole environment, including seasonal changes. Great expansion is indicated in the use of micro-organisms of various types in the control of pests, and it is concluded that there is no justification for considering the method of biological control to be of decreasing value, but that there will be a continued and probably increasing place for it in the future.

Pickett (A. D.). **Utilization of native parasites and predators.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1103–1105, 1 fig., 7 refs. Menasha, Wis., 1960.

The following is substantially the author's abstract. In apple orchards in Nova Scotia, the general use of a programme of selective sprays for several years has been followed by a reduction in the amount of damage caused by *Lepidosaphes ulmi* (L.),, *Cydia* (*Carpocapsa*) *pomonella* (L.), *Spilonota ocellana* (Schiff.), *Anuraphis roseus* Baker, *Aphis pomi* Deg. and *Panonychus ulmi* (Koch) [*cf. R.A.E.*, A **46** 190, etc.]. Although proof has not been obtained in all cases, the evidence indicates that beneficial species survived in greater numbers and sometimes increased substantially when selective materials were applied. In the development of such a programme, emphasis should be placed on the use of selective compounds, the timing of applications to avoid susceptible stages of beneficial species and determination of the minimum dosages necessary to control the pests.

Smith (R. F.) & Hagen (K. S.). **Integrated control programs in the future of biological control.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1106–1108, 15 refs. Menasha, Wis., 1960.

The following is virtually the authors' abstract. Integrated control is applied pest control that combines and integrates biological and chemical control. Chemical control is used as necessary and in a manner that is least disruptive to biological control. Integrated control may make use of naturally occurring biological control as well as biological control effected by manipulated or introduced biotic agents. The development of integrated control programmes opens new horizons for the utilisation of natural and biological controls.

Young (W. R.) & Sifuentes A. (J. A.). **Biological and control studies on *Estigmene acrea* (Drury), a pest of corn in the Yaqui Valley, Sonora, Mexico.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1109–1111, 4 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract. In the Yaqui Valley of Sonora, in north-western Mexico, *Estigmene acraea* (Dru.) caused severe

damage to autumn-sown maize in 1957 and 1958. Field observations and insectary studies showed that the preferred native food-plants of this Arctiid, both for oviposition and for larval development, are *Amarantus palmeri* and *Physalis angulata*. Studies of the bionomics of *E. acraea* indicated that the time required for development from egg to adult is about a month in July–September, when the largest populations are produced, and that there are 4–5 generations a year. Natural enemies observed included *Ceratomegilla* (*Coleomegilla*) *maculata* (Deg.) and *Collops femoratus* Schaeffer, feeding on the eggs, and *Zelus laevicollis* Champ. and *Sinea confusa* Caudell, attacking young larvae; late in the season of 1958, many larvae were killed by *Entomophthora aulicae*, but none of these enemies prevented the development of large populations in late summer and autumn. When applied to maize in about 18 gal. spray per acre in September 1958, 0·45 lb. trichlorphon (Dipterex) gave promising control, but 2·6 lb. toxaphene, 0·36 lb. endrin, 0·9 lb. heptachlor and 0·45 lb. parathion, methyl-parathion or Thiodan were ineffective.

Semel (M.). **Control of the corn earworm attacking sweet corn.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1111–1114, 7 refs. Menasha, Wis., 1960.

The following is based on the author's abstract. Severe damage by *Heliothis zea* (Boddie) to sweet maize on Long Island in 1955, despite treatment with DDT, suggested that the earworm might have become resistant to this insecticide, but experiments in 1956–58 showed that it was still very effective. DDT at 1·5 lb. and Sevin at 0·5–1·5 lb. per acre in emulsion sprays gave the best results, and endrin, Thiodan, azinphos-methyl (Guthion) and Shell 4402 (1,3,4,5,6,7,8,8-octachloro-3a,4,7,7a-tetrahydro-4,7-methanophthalan) at about 0·5 lb. per acre, also in emulsion sprays, were promising. DDT, endrin, azinphos-methyl, 0·5 lb. mevinphos (Phosdrin) in emulsion spray and 2·85 lb. ryania in a wettable-powder spray caused considerable reductions in ear damage by *Ostrinia* (*Pyrausta*) *nubilalis* (Hb.), and Thiodan was partially effective. No DDT and insignificant Sevin residues were found on husked ears 10 days after treatment. Various proprietary surface-active supplements had little or no effect in enhancing or prolonging the effectiveness of DDT, with the possible exception of Atlas NNO, which seemed to improve control in one test.

Gast (R. T.). **The relationship of weight of Lepidopterous larvae to effectiveness of topically applied insecticides.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1115–1117, 6 refs. Menasha, Wis., 1960.

Lepidopterous larvae of four species were treated topically with several insecticides, and the LD50's determined in μg. per g. larval weight after 48 hours. When the larvae of each species were divided into groups according to their weight, it was found that there was little change in the LD50's of DDT and mevinphos (Phosdrin) for *Prodenia eridania* (Cram.) or of endrin for *Protoparce sexta* (Joh.). With *Heliothis zea* (Boddie), the LD50 of mevinphos was constant, but that of DDT was more than 1,000 times as great for larvae weighing 0·5 g. as for those weighing 0·1 g. Mevinphos also had a fairly constant LD50 for *H. virescens* (F.), but the LD50's of azinphos-methyl (Guthion), trichlorphon (Dipterex) and malathion were 2–10 and those of endrin, DDT, toxaphene and DDD (TDE) 20–100 times as great for large larvae (0·4–0·44 g.) as for small ones (0·05–0·29 g.).

Breakey (E. P.). **Control of root weevils in strawberry plantings.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1117–1119, 1 fig., 9 refs. Menasha, Wis., 1960.

In tests of lindane [almost pure γ BHC], aldrin, heptachlor and chlordane for the control of *Otiorhynchus* (*Brachyrhinus*) *ovatus* (L.), *O.* (*B.*) *rugostriatus* Goeze and *O.* (*B.*) *sulcatus* (F.) attacking strawberry in western Washington, wettable powders were diluted with talc and mixed with soil that was low in organic matter before the plants were set and the plants were artificially infested with the weevils during the spring and summer of 1953. By 1958, larvae were numerous among the roots of plants in the untreated plots and γ BHC at up to 10 lb. per acre was not affording control. Aldrin and heptachlor at 2·5–10 lb. were still effective, particularly at 10 lb., and chlordane at 5–20 lb. rather less so; soil analysis showed that most of the aldrin had been converted to dieldrin [*cf. R.A.E.*, A **47** 56].

Roberts (J. E.), Dupree (M.) & Dawsey (L. H.). **Insecticide residues on sweet potatoes.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1119–1121, 4 refs. Menasha, Wis., 1960.

Tests in Georgia in 1955–58 to find the residues left on sweet potatoes by insecticides applied to protect them from insects showed that applications of 2 lb. aldrin or heptachlor per acre with the fertiliser before planting resulted in values about or below the legal tolerance of 0·1 part per million on unwashed sweet potatoes, and 2 lb. dieldrin, 5 lb. DDT and 10 lb. toxaphene in about as much. Dusting the foliage with 4 lb. aldrin or heptachlor per acre resulted in very low residues, but sometimes considerably increased those left by soil treatments. When the sweet potatoes were washed, as is usual in Georgia, all residues were much below the tolerance level.

Fukuto (T. R.), Metcalf (R. L.) & Winton (M.). **Alkylphosphonic acid esters as insecticides.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1121–1127, 1 graph, 19 refs. Menasha, Wis., 1960.

Since little was known of the insecticidal properties of alkyl phosphonates other than EPN and trichlorphon (Dipterex), a series of these compounds was tested for toxicity to several insects.

LD50's for *Musca domestica* L. were determined topically and correlated with inhibition of fly-brain cholinesterase and hydrolysis rates. Among the ethyl p-nitrophenyl alkylphosphonates, toxicity decreased slightly in straight-chain compounds as the alkyl portion was varied from methyl to butyl, all being at least as toxic as paraoxon (LD50 1·2 μg. per g.), decreased abruptly for the amyl and hexyl compounds, and was increased by unsaturation, the allyl compound being nearly twice as toxic as the n-propyl. The phenyl compound was also very toxic and much more so than the cyclohexyl. The results for branched-chain compounds were more complex, toxicity being reduced considerably in some. Toxicity in all these compounds varied consistently with the reactivity of the molecule, measured in terms of hydrolysis constants, bimolecular rate constants for the reaction with fly-brain cholinesterase and the polar substituent constants.

Among alkyl p-nitrophenyl ethylphosphonates, the effects were less marked; toxicity decreased only slightly when the alkyl chain was extended from methyl to butyl and was still relatively high at C_6 and C_8. O-Ethyl

O-p-nitrophenyl ethylphosphonothioate, the most toxic of all the compounds, and EPN were slightly more and O-ethyl O-p-nitrophenyl butylphosphonothioate less toxic than their oxygen analogues, although they were all more stable to hydrolysis and had lower rates of cholinesterase inhibition, and it is presumed that conversion of double-bonded sulphur to double-bonded oxygen occurs in animals during the poisoning process. The S-ethyl, S-n-propyl and S-isopropyl p-nitrophenyl ethylphosphonothioates were only one-sixth as toxic as their oxygen analogues, although very effective inhibitors of cholinesterase, and this was probably due to their relatively high susceptibility to hydrolysis. Ethyl S-p-nitrophenyl ethylphosphonothioate, in spite of slightly higher anticholinesterase activity, was, unexpectedly, even less toxic than the S-ethyl isomer.

A strain of *M. domestica* that was very resistant to DDT- and cyclodiene-type chlorinated hydrocarbons was almost completely susceptible and one that was resistant to Chlorthion and malathion only slightly resistant to both O-ethyl O-p-nitrophenyl ethylphosphonothioate and EPN.

When tested topically against *Periplaneta americana* (L.) and as surface residues on oranges against adult females of *Panonychus citri* (McG.) and *Heliothrips haemorrhoidalis* (Bch.), ethyl p-nitrophenyl propylphosphonate was slightly more toxic than paraoxon, O-ethyl O-p-nitrophenyl ethylphosphonothioate and parathion, which decreased in that order, to the first, and than paraoxon and parathion, which were about equal, to the other two. O-Ethyl O-p-nitrophenyl ethylphosphonothioate was equal or superior to parathion against *M. domestica* and, in residues on cotton leaves, against larvae of *Estigmene acraea* (Dru.). In solution in water containing fourth-instar larvae of *Culex pipiens fatigans* Wied. (*quinquefasciatus*, auct.), the propylphosphonate and paraoxon were about equally toxic and less so than the ethylphosphonothioate and parathion, which were comparable in effect.

Irabagon (T. A.). **Rice weevil damage to stored corn.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1130–1136, 3 figs., 3 refs. Menasha, Wis., 1960.

The following is taken mainly from the author's abstract. *Sitophilus oryzae* (L.) [*cf. R.A.E.*, A **48** 130] is one of the most harmful pests of stored maize in North Carolina. In investigations on the loss of weight and nutritive value of the grain due to it, single kernels and samples of 20 and 250 g. were infested with weevils and stored at 60, 70 and 80°F. and 50 per cent. relative humidity. The total loss in weight was directly proportional to the number of weevils in the maize and was greatest at 80°F. Weevils caused 74·7 per cent. loss in weight in the single kernels and 12·9 and 25·9 per cent., respectively, in the 20- and 250-g. samples. Chemical analysis of these showed an increase of protein content with increasing infestation, and mice that were fed on meal from heavily infested maize ate less and showed less gain in weight than those fed on meal from uninfested or lightly infested maize.

Mason (H. C.), Henneberry (T. J.) & Lehr (R.). **Experiments with insecticides for the control of** *Drosophila* **breeding.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1136–1138, 1 fig., 6 refs. Menasha, Wis., 1960.

Drosophila melanogaster Mg. breeds in cull piles of fruits and vegetables and spreads from them to tomatos grown for canning, and organic insecticides were tested against it in Maryland in 1954–56. In laboratory tests

of 17 compounds, applied in 1 per cent. sprays to canned pumpkin in which *D. melanogaster* was breeding, only DDD (TDE) and piperonyl butoxide failed to give complete control, and these reduced breeding by 80 and 95 per cent., respectively. Field-cage tests were carried out in 1954 [*R.A.E.*, A **45** 439] and in 1955, when 0·1 per cent. fenchlorphos (ronnel), phorate (Thimet), aldrin, dieldrin, lindane [almost pure γ BHC], isodrin, heptachlor and dicapthon with attractants caused 97–100 per cent. reduction in breeding, 0·2 per cent. malathion 88 per cent. and 0·1 per cent. dichlorvos (DDVP) 78 per cent.

Insecticides were also tested in 1954–56 on piles of waste tomatos in the field, and 0·5 per cent. malathion, trichlorphon (Dipterex), chlordane, aldrin or methoxy-DDT (methoxychlor) or 0·25 per cent. dieldrin, dicapthon, diazinon, ethion, heptachlor or fenchlorphos in sprays and 5 per cent. fenchlorphos in granules almost completely prevented breeding for about a month. Single applications of 1·5 and 0·75 per cent. malathion in emulsion spray to piles of tomato refuse at a commercial cannery in 1954 and 1955, respectively, completely prevented breeding for 27 days or longer.

Vanderzant (E. S.), Richardson (C. D.) & Davich (T. B.). **Feeding and oviposition by the boll weevil on artificial diets.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1138–1143, 7 refs. Menasha, Wis., 1960.

The following is substantially the authors' abstract of this account of investigations on artificial diets for the adults of *Anthonomus grandis* Boh. Basic diets contained an enzymatic hydrolysate of casein, glucose, maize oil, cholesterol, Wesson's salts, choline, ascorbic acid, B vitamins, water and agar, and the addition of 0·1–5 per cent. mixed pollens stimulated feeding and oviposition. Five generations were reared without access to cotton by using a diet based on soy-bean protein for the immature stages [*cf. R.A.E.*, A **47** 322] and allowing the adults to feed and oviposit on a diet containing mixed pollen. Oviposition occurred when pollen from plants of different families was used, and the only other substance that appreciably stimulated it was wheat germ. A basic diet containing homogenates of heated cotton-plant parts, squares, flowers, germinated cottonseed and young green seedlings also induced the weevils to feed and oviposit. Tests with modifications of the basic diets are described.

Pruess (K. P.). **Effect of host condition on the clover root borer.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1143–1145, 5 refs. Menasha, Wis., 1960.

In Ohio in 1954 and 1955, examination of samples of 30 roots of living or dead clover plants taken in the same field showed that, in most cases, populations of *Hylastes* (*Hylastinus*) *obscurus* (Marsham) were considerably higher and the insects further developed in the dead plants. Statistical analysis of the results from roots collected at intervals in June–August showed that oviposition was completed earlier in weakened plants, but that development was more rapid in vigorous or lightly infested roots. High populations early in the season weakened or killed the plants and subsequently delayed borer development.

Everly (R. T.) & Payne (K. T.). **Effect of pre-seeding insecticide treatments of the seed bed on red clover stands and forage yields.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1145–1154, 3 figs., 11 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract. In investigations in Indiana, massive dosages of DDT, BHC, chlordane, toxaphene and parathion, all with an organic fungicide, Arasan [thiram] were applied to the soil and disked in with a rotary hoe in May 1950, and four varieties of medium red clover [*Trifolium pratense*] were sown in the treated soils and subjected to the best cultural practices and methods of controlling insects and diseases. Insect populations in July 1951 showed marked differences between the treatments, particularly as regards grasshoppers, aphids (*Macrosiphum pisum* (Harris)), Diptera and Hymenoptera. Differences in the stand between treatments in the seeding year were highly correlated with those in the next year. The effect of BHC in reducing grasses and the companion oat crop was marked, and resulted in the best clover stands throughout the experiment. Yields, when corrected for stand differences, were significantly affected. Second-crop forage yields showed notable differences among the varieties and were highest on plots treated with BHC. A final inspection on 17th October 1951 showed that these and plots treated with a mixture of the insecticides had the best stands of all varieties.

Lau (N. E.) & Filmer (R. S.). **Injury of clover root curculios to red clover in New Jersey.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1155–1156, 2 refs. Menasha, Wis., 1960.

Surveys of fields of red clover [*Trifolium pratense*] in New Jersey in 1955–57 showed that *Sitona hispidulus* (F.), with a small proportion of *S. flavescens* (Marsham), was abundant throughout the State and that the larvae were feeding extensively in seedling and second-year stands and were the most numerous of all insects attacking the roots. Counts in representative fields indicated that, during the feeding period, they made an average of 1·22 feeding scars per larva in roots 0·125 in. or more in diameter, and estimates on this basis in plots that were sampled after the insects had transformed to adults and left the soil indicated that as many as 124 larvae per sq. ft. had been present, 50 or more being not unusual. Estimated populations throughout the State averaged about 73 per sq. ft.

Getzin (L. W.) & Chapman (R. K.). **Effect of soils upon the uptake of systemic insecticides by plants.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1160–1165, 1 graph, 13 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract. In evaluating the efficiency of soil treatments with systemic insecticides, it was noted that their effectiveness often depended on soil conditions, and experiments were therefore carried out in Wisconsin to determine the effect of soil type on absorption of the insecticides from the soil and the soil characteristics that protect them against leaching.

Absorption of mevinphos (Phosdrin), demeton, phorate, schradan and Isolan by peas from four soils and two sands treated with drenches was measured by anticholinesterase analysis and bioassay with *Macrosiphum pisum* (Harris). Greater residues and longer periods of insect kill were observed for sands and sandy soil than for silt loam, clay loam and muck

soil. The duration of aphid control by mevinphos varied from two days on plants grown in loam and muck to 19 days on plants in sand; demeton and phorate were least effective in the muck soil, and schradan in the muck and silt loam. Unlike the others, Isolan was absorbed in greater amounts from the muck than from either of the loams. Anticholinesterase analysis of plants grown in soil treated with Isolan and mevinphos gave results comparable with those obtained by bioassay.

The binding of an insecticide in soil was studied by leaching radioactive mevinphos through columns of 12 soils. The largest amounts were bound by peat (127 μg. per 100 g. soil), as compared with 10–27 and 3–8 μg. per 100 g. by heavy loam and sandy soils, respectively. The amount bound was positively correlated with the base exchange capacity and content of nitrogen and organic matter of the soil, but the last was primarily responsible. Other chemical and physical soil properties showed no effect.

Pruess (K. P.) & Weaver (C. R.). **Effects of moisture on the clover root borer and red clover yields.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1166–1167, 7 refs. Menasha, Wis., 1960.

In tests in Ohio in 1955–56 on the effect of moisture on injury by *Hylastes* (*Hylastinus*) *obscurus* (Marsham), red clover [*Trifolium pratense*] was grown in pots under shelter in the field and watered weekly at rates equivalent to 0·5–6 in. rainfall a month. Cuttings of hay in June, July and August–September showed significantly lower yields from plants infested with the Scolytid than from those protected from it by dieldrin, and the percentage loss was least in the first cutting and greatest in the third. Increased moisture resulted in increased yields in the first two cuttings, but not in the third, and had little, if any, effect on borer damage, although populations were highest under dry conditions and lowest under wet ones.

Burditt jr. (A. K.) & Holdaway (F. G.). **An evaluation of resistance of corn leaf tissue to feeding by European corn borer larvae.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1171–1180, 5 figs., 21 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract. In Minnesota in 1954, five related inbred lines of field maize were evaluated for resistance to leaf-feeding by *Ostrinia* (*Pyrausta*) *nubilalis* (Hb.) by field and laboratory methods that are described. Two resistant and one susceptible strain and their common parents, one resistant and one susceptible, were used, and the survival of larvae feeding on resistant and susceptible leaf tissue was generally similar in the laboratory and in the field. The results showed that resistance was due primarily to antibiosis [*cf. R.A.E.*, A **45** 352] and that differences in survival of newly hatched larvae reflected differences in planting date, stage of growth of the plants and maturity of the leaf tissue as well as differences in plant resistance. Although care must be taken whenever data obtained in the laboratory are compared with data from the field or other types of laboratory studies, the available evidence indicates that the laboratory technique employed will prove useful in furthering the understanding of resistance. It has the advantage that small samples (1·5 × 3 in.) of leaf tissue from the parts of the plant where resistance is most effective are evaluated for the presence of resistant factors. The use of related inbred lines demonstrated some of the genetic implications of resistance studies.

Waters (W. E.). **A quantitative measure of aggregation in insects.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1180–1184, 1 fig., 15 refs. Menasha, Wis., 1960.

The following is virtually the author's abstract. Aggregation is both a statistical and a fundamental biological characteristic of insects and other animals. The aggregative behaviour of non-social as well as of social insects has a direct bearing on reproduction and survival and thus affects population dynamics and evolutionary trends. Owing to the distinct life-stages of most insects, aggregation must be assessed throughout the entire life-cycle.

The occurrence of insects in natural units of their habitats is best expressed as a frequency series. The negative binomial distribution has proved applicable to a wide range of insect counts, and its parameter k is a valid, readily computed measure of aggregation. Examples from hypothetical and natural populations are given, to demonstrate its utility.

Use of the smallest feasible natural unit for sampling, multiple (nested) sampling and stratification of the data by population density and other criteria will increase the accuracy and reliability of estimates of k.

Wattal (B. L.) & Cutkomp (L. K.). **The relationship between density and mortality of flour beetles exposed to insecticide-treated surfaces.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1184–1190, 6 graphs, 10 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract. When adults of *Tribolium confusum* Duv. and *T. castaneum* (Hbst.) were exposed in closed petri dishes to filter papers treated with DDT or pyrethrins, the resulting mortality was much higher at high insect densities (three or more per sq. cm.) than at low ones (one or less per sq. cm.); mortality increased progressively over the range of densities studied. The results were obtained from surfaces bearing more insecticide than was picked up by the beetles, and the differences in mortality did not occur in uncovered dishes or when the beetles were exposed to a thiocyanate (Lethane 384).

The causes of such differences in mortality would appear to be associated with some volatile material, but tests of the effects of the secreted quinone compounds and of accumulated carbon dioxide were negative. As experiments in other laboratories have shown a large increase in oxygen consumption after exposure to DDT or pyrethrins and a decrease after exposure to the thiocyanate [*R.A.E.*, A **38** 297; **40** 160], it is deduced that when many beetles are exposed to DDT or pyrethrins in closed dishes, they use up enough oxygen to cause a critical need and thus succumb more readily to the quantity of insecticide picked up.

Other factors were studied, but did not show a positive correlation with the differences in mortality; the rate of movement was greater with a greater density of beetles, whether the dishes were covered or not, but there was no marked difference in the amount of insecticide picked up.

Knight (F. B.). **Partial life tables for the Black Hills beetle.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1199–1202, 3 graphs, 7 refs. Menasha, Wis., 1960.

The following is based on the author's abstract. Life tables [*cf. R.A.E.*, A **48** 142] have been developed for use in ecological studies of *Dendroctonus ponderosae* Hopk. attacking ponderosa pine [*Pinus ponderosa*] in several

areas in the western United States. They reveal very high mortality during development, averaging more than 99 and 90 per cent., respectively, in decreasing and increasing infestations, and about 97 per cent. in static ones. The critical period is between April and July of the spring after the initial attack on the trees, late in the life-cycle of the bark-beetle.

Residues in fatty tissues, brain, and milk of cattle from insecticides applied for grasshopper control on rangeland.—*J. econ. Ent.* **52** (1959) no. 6 pp. 1206–1210, 9 refs. Menasha, Wis., 1960.

Grasshoppers are important pests of range forage in the western United States, and insecticides, which provide the only practical method of control, leave residues that may appear in the fat of the grazing animals. The residues were investigated in 1956–58, and the following is based on the abstract of the work.

In 1956, cattle exposed to rangeland treated with 2 oz. aldrin per acre for different periods showed averages of 1·4–10·9 parts dieldrin [*cf. R.A.E.*, A **46** 99] per million in the fat when slaughtered, within three days of removal from the range. In 1957, steers were exposed for 58–90 days to rangeland treated with 2 oz. aldrin, 3 oz. heptachlor or 0·75 oz. dieldrin per acre and then confined in a feed lot for 93–100 days. Dieldrin residues from the aldrin treatment were about 4 p.p.m. in the fat when the animals were removed from the range and about 0·9 p.p.m. when they were slaughtered, those of heptachlor epoxide from the heptachlor treatment were of the same magnitude and those from dieldrin were about 7 and 1·4 p.p.m., respectively.

In 1958, cattle were grazed for 96–103 days on ranges treated with 2 oz. aldrin or heptachlor per acre in diesel oil or emulsion or with 1·5 lb. toxaphene in diesel oil and then confined in a feed lot for 120 days before slaughter. Residues of dieldrin and heptachlor epoxide were about the same as in 1957; those from aldrin were only slightly affected by the formulation used, but those from heptachlor were lowest in animals from the range treated with emulsion. Animals exposed to toxaphene had residues of less than 0·5 p.p.m. The milk from cows exposed to range treated with 2 oz. heptachlor per acre contained residues of 13·3 p.p.m. heptachlor epoxide in the butterfat (about 0·5 p.p.m. in the milk) after 28 days and 1 p.p.m. after 165 days.

Hunt (R. W.). **Wood preservatives as deterrents to drywood termites in the southwest.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1211–1212, 4 refs. Menasha, Wis., 1960.

Inspection in 1959 showed that spraying Douglas fir [*Pseudotsuga menziesii*], used for the frame of a small building near Whither, California, with a solution of copper sulphate, containing a wetting agent, and other wooden framing with a 2 per cent. emulsion of copper naphthenate, alone or with DDT or lindane [γ BHC], had protected them from attack by *Kalotermes minor* Hagen for 22 and about 11 years, respectively; field observations confirmed that wood preservative applied by spray or brushing, dipping or pressure treatment, deterred both saprophytic fungi and termites. The availability and cost of treatment are discussed and it is concluded that, in southern California, the use of relatively small amounts of a preservative, preferably one containing copper, is worth the cost to house owners; treatment of cut ends, notches and bored holes is particularly important.

Cook (W. C.). **Thimet as a low-temperature fumigant against the pea aphid.**—*J. econ. Ent.* **52** (1959) no. 6 p. 1212. Menasha, Wis., 1960.

Since rapid control of *Macrosiphum pisum* (Harris) on lucerne with granules of phorate (Thimet) applied to the soil in Washington in February 1957 indicated a fumigant effect, a further test was made in 1958, in which 2 per cent. granules were applied at 0·5 or 1 lb. per acre on 21st February to lucerne in plots with an average infestation of 0·77 aphids per tip. Counts made a week later showed no aphids on treated plots, one per tip on an untreated plot to windward of the treated ones and 0·05 per tip on two other untreated plots, indicating considerable drift of the phorate vapour. Aphids caged for 48 hours at this time on stripped plant terminals showed much growth and reproduction, with no significant difference between treated and untreated plots, and it was concluded that no detectable absorption or translocation of phorate had occurred and that field mortality was entirely due to fumigation.

Phorate granules subsequently gave complete mortality of aphids that had been used to transmit viruses to plants, when they were left near the plants under a plastic tarpaulin for 48 hours. This fumigant action is particularly valuable as it occurred at temperature ranges as low as 29–64 and 30–67°F.

Smith (P. W.), Taylor (J. G.) & Apple (J. W.). **A comparison of insect traps equipped with 6- and 15-watt blacklight lamps.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1212–1214, 1 fig., 4 refs. Menasha, Wis., 1960.

Two light-traps, which are described, were operated for 34 consecutive nights in the late summer of 1958 in a field at Arlington, Wisconsin. One had a 15-watt and the other a 6-watt ultraviolet lamp, and the baffle area of the latter was 30 per cent. of that of the former. Catches were good only on nights when the temperature was at least 60°F. at 10 p.m., and were generally greater in the bigger trap, though the differences were significant only for five species, of which the numbers were about twice as great. It appears that where a smaller trap and smaller catches are desired, the 6-watt trap samples responsive nocturnal insects adequately.

Siakotos (A. N.) & Dewey (J. E.). **The effects of a diet containing gibberellic acid on the growth and food consumption of *Periplaneta americana* L.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1214–1215, 1 ref. Menasha, Wis., 1960.

In view of the possibility that insects may feed on plants that have been treated with gibberellic acid to modify their growth, the effect of the ingested acid was tested. Cockroaches (*Periplaneta americana* (L.)) of age-groups having average weights of 0·005, 0·0789 and 0·5542 g. were fed for 35 days on diets containing 0, 0·01, 1 or 100 parts gibberellic acid per million. Mortality was variable within and between groups, but highest in the youngest, whether or not the acid had been administered. The concentration of acid had no significant effect on weight increase or on egg-production.

Landis (B. J.). **The economic importance of *Pleurophorus caesus* Creutz.**—*J. econ. Ent.* **52** (1959) no. 6 p. 1215, 4 refs. Menasha, Wis., 1960.

It is reported from Washington State that *Pleurophorus caesus* (Creutz.) was present in the underground parts of potato stems in July–September

1941, being apparently restricted to plants affected by leaf-roll and fungus diseases, and was rather abundant in many potato fields in the Yakima Valley in subsequent years. The adults of the Aphodiid became active in April and entered the planted seed pieces, usually through wounds or wireworm tunnels; a group of 60 adults was found, apparently hibernating, in soil cracks in an abandoned potato field in October 1943. *P. caesus* was found among the roots of ladino clover [*Trifolium repens latum*] in May 1951, but did not appear to be injurious, and it destroyed about 20 per cent. of small cucumber plants by mining in the stems in May 1956.

English (L. L.) & Snetsinger (R.). **Control of the leaf miner** *Profenusa canadensis* (**Marlatt**) **on cockspur hawthorns.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1218–1219, 5 refs. Menasha, Wis., 1960.

The authors give a short account of the life-history and habits of *Profenusa canadensis* (Marl.), which is a serious pest of morello cherry and *Crataegus crusgalli* in the United States. In Urbana, Illinois, the adults of this sawfly emerge in late April and oviposit within about a week. The larvae hatch in a few days, complete their feeding within the leaves by about 20th May and drop to the ground, where they overwinter and pupate in early spring; there is only one generation a year.

Spray experiments on *Crataegus* in 1956 showed that malathion was ineffective for control, and lindane [γ BHC] and dieldrin promising when applied on 30th April or 7th May, but not earlier or later. In tests in 1957–59, in which emulsion concentrates were used at 1 quart per 100 gal., 20 per cent. γ BHC and 23·5 per cent. aldrin gave very good control and 15 per cent. dieldrin was not significantly better; treatments should be applied when the leaves are nearly grown and the new shoots 4–6 in. long.

Harding (J. A.). **Evaluation of insecticides for tomato suckfly control.**—*J. econ. Ent.* **52** (1959) no. 6 pp. 1219–1220, 6 refs. Menasha, Wis., 1960.

Cyrtopeltis notatus (Dist.) increased on tomato in the Winter Garden area of Texas in late April 1959, and 16 synthetic organic insecticides were tested for its control in emulsion sprays applied at 5 U.S. gal. per acre on 6th–8th May, when the plants were 10–27 in. tall. Counts made 1–7 days after treatment indicated that ethyl-DDD (Perthane), Dibrom (dimethyl 1,2-dibromo-2,2-dichloroethyl phosphate) and methoxy-DDT (methoxychlor) had little initial effect and that 0·5 lb. azinphos-methyl (Guthion) or dimethoate and 0·25 lb. demeton per acre probably had a more prolonged effect than the other materials tested, which all showed good initial control, with little difference between them.

Kantack (B. H.). **Laboratory studies with** *Bacillus thuringiensis* **Berliner and its possible use for control of** *Plodia interpunctella* (**Hbn.**).—*J. econ. Ent.* **52** (1959) no. 6 pp. 1226–1227, 3 refs. Menasha, Wis., 1960.

Preliminary tests having shown that larvae of *Plodia interpunctella* (Hb.) were very susceptible to *Bacillus thuringiensis* when the spores were incorporated in the culture media, their effect when applied to whole grain was tested. Wheat or dent maize was mixed with spore suspensions, infested with larvae 10–14 days old and examined periodically for adult

emergence. The larvae proved very susceptible to infection, showing symptoms after feeding on the treated grain for only a few hours, and exposure to 12·5 million spores per g. grain reduced adult emergence from 84 to 1 per cent. in wheat and from 77 to 12 per cent. in maize. Limited observations indicated that the eggs laid by surviving adults did not acquire enough spores to prevent the development of hatching larvae.

Miller (J. M.) & Keen (F. P.). **Biology and control of the western pine beetle. A summary of the first fifty years of research.**—*Misc. Publ. U.S. Dep. Agric.* no. 800, vii + 381 pp., 70 figs., 151 refs. Washington, D.C., 1960.

Dendroctonus brevicomis Lec. (western pine beetle) is a pest of pines, mainly *Pinus ponderosa* and *P. coulteri*, in the west of the United States. Research on numerous aspects of its bionomics, ecology and control has been carried out since 1902, and the results are here summarised from the literature and manuscript reports for the period up to 1st July 1952.

Butcher (J. W.) & Haynes (D.). **Fall control of European pine shoot moth on pine seedlings.**—*Quart. Bull. Mich. agric. Exp. Sta.* **41** no. 2 pp. 264–268, 2 refs. East Lansing, Mich., 1958.

Treatments are necessary in Michigan to ensure that pine seedlings are freed from larvae of *Rhyacionia buoliana* (Schiff.) before they are despatched from nurseries. In tests in the autumn of 1957, the best results were given by mevinphos (Phosdrin). When it was applied in sprays to *Pinus resinosa* (red pine) at a rate of 1 lb. active material per 100 U.S. gal. water on 11th September, the mean number of living larvae per injured seedling three weeks later was 0·02 (or 0·04 when a polyvinyl-chloride spreader-sticker was incorporated), as compared with 0·34 (0·24), 0·4 (0·51) and 0·4 (0·37) for 1 lb. azinphos-methyl (Guthion), 6 lb. DDT and 3 lb. γ BHC, respectively, and 0·56 for no treatment. None of the plants showed any spray injury in the spring of 1958. When the foliage of bundles of infested seedlings was dipped for ten seconds in the same insecticides, except for BHC, 99 and 83 per cent. kill was given within ten days by mevinphos with and without the sticker, and azinphos-methyl and DDT were less effective. In further dipping tests, seedlings of *P. sylvestris* (Scots pine) were immersed for longer periods in mevinphos, with Triton X-100 as a wetting agent. Immersion for 3 or 15 minutes resulted in complete kill of *R. buoliana* within two weeks, but when the period was reduced to 30 seconds or the seedlings were washed immediately or one hour after dipping, there were some survivors. In all the tests, the larvae that survived the treatments with mevinphos had burrowed deeply into the base of large buds on *P. resinosa* or were protected by pitch exudation from the buds of *P. sylvestris*. It is concluded that treatment should be applied in late summer as soon as infestation is noticed and that success is more likely with small seedlings; those used in the tests were three years old.

Haynes (D. L.), Guyer (G.) & Butcher (J. W.). **Use of systemic insecticides for the control of the European pine shoot moth infesting red pine.**—*Quart. Bull. Mich. agric. Exp. Sta.* **41** no. 2 pp. 269–278, 3 refs. East Lansing, Mich., 1958.

The following is based largely on the authors' summary of this account of tests with systemic phosphorus insecticides for the control of *Rhyacionia*

buoliana (Schiff.) [*cf. R.A.E.*, A **46** 259] in plantations of red pine [*Pinus resinosa*] 6–7 years old at two places in the Lower Peninsula of Michigan in 1956–57. Phorate (Thimet), mevinphos (Phosdrin), Bayer 19639 [O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate] and Am. Cyanamid 12008 [O,O-diethyl S-isopropylthiomethyl phosphorodithioate] were tested as foliar sprays, phorate and Bayer 19639 in granules as soil treatments, and phorate and mevinphos as soil drenches and on gauze bands attached to the trunks. The highest initial control was given by foliar sprays of mevinphos, Am. Cyanamid 12008 and phorate at 2 lb. per 100 U.S. gal. water, applied in April or August, but only soil treatments with phorate as a drench at 10 lb. active material per acre or as 2 and 4 per cent. granules at 0·25–0·5 lb. toxicant per tree significantly reduced populations of the succeeding generation. Foliar treatments were more effective in spring than in August. The trunk treatments were of little value, and soil treatments applied in August were ineffective. Systemic activity was shown in the following spring by all the phorate treatments applied in August at one place, and the other materials showed increased systemic activity in the spring. The granules containing Bayer 19639, applied to the soil at 10 lb. active ingredient per acre, showed systemic action in about a month at one place, but both this treatment and a spray of the same material at 2 lb. per 100 U.S. gal. failed to give significant mortality. There were wide differences between results from the two places, possibly because of physiological differences between the trees.

Fox (R. C.). **Seasonal development of the smaller European elm bark beetle in southern Michigan.**—*Quart. Bull. Mich. agric. Exp. Sta.* **41** no. 2 pp. 279–287, 3 figs., 2 refs. East Lansing, Mich., 1958.

Dutch elm disease, caused by *Ceratocystis ulmi*, was detected for the first time in Michigan in the Detroit area in 1950, and has since been found in all the southern counties of the State. The fungus is disseminated by *Scolytus multistriatus* (Marsham), and the seasonal development of this beetle was investigated in 1955–57 in felled sections of American elm (*Ulmus americana*) caged upright in semi-shaded positions in the open and by other cage techniques. The pattern of emergence was similar to that in south-western Ontario [*cf. R.A.E.*, **46** 483], but the dates were somewhat earlier. There were two generations a year, with peaks of emergence in late June and from late July to late August, varying with weather conditions. In 1955, when the mean temperature for April was 54·5°F. (as compared with a mean of 45·3°F. for 1921–50), emergence of adults of the overwintered generation began on 20th May and that of the first generation on 30th June, but, despite these unusually early appearances, there was no indication of a third generation. Adult overwintering was not observed. In 1957, there was high rainfall in April and May and many larvae were killed in their galleries by an unidentified fungus. The need for the immediate destruction of elm timber during the summer months is emphasised.

Haines (R. G.). **Controlling fruit insects by aircraft application. I. Apples.**—*Quart. Bull. Mich. agric. Exp. Sta.* **41** no. 2 pp. 410–420. East Lansing, Mich., 1958.

Investigations on the effectiveness of aeroplanes for the application of dusts to orchards were begun in Michigan in 1958. Piper and Stearman aircraft were used, and the results as concerned apple orchards are here given in detail in tables and discussed. It was found that applications of

standard materials, including DDT, parathion and mixtures of them, sometimes with acaricides, gave good control of the principal insect pests, which included the codling moth [*Cydia pomonella* (L.)], the red-banded leaf roller [*Argyrotaenia velutinana* (Wlk.)] and aphids, but were unsatisfactory against mites, owing to poor coverage of the lower surfaces of the leaves. Dusts of 2·5 per cent. azinphos-methyl (Guthion) and a mixture of 10 per cent. Sevin and 3 per cent. Tedion were evaluated and found very effective against *C. pomonella* and *A. velutinana*; the first was also excellent against the rosy aphid [*Anuraphis roseus* Baker]. Aerial dusting appeared in general to be less effective than ground spraying, but it has compensating advantages, including good fruit appearance. Methods of formulation made little difference to the coverage afforded by a 4 per cent. malathion dust, and the quantity deposited on vertical surfaces was independent of flight direction; coverage of lower horizontal surfaces was poor.

Cumming (M. E. P.). **The biology of** *Adelges cooleyi* **(Gill.) (Homoptera: Phylloxeridae).**—*Canad. Ent.* **91** no. 10 pp. 601–617, 14 figs., 14 refs. Ottawa, 1959.

Chermes (*Adelges*) *cooleyi* Gill., which is indigenous in North America, causes galls on white spruce (*Picea glauca*) and Engelmann spruce (*P. engelmanni*) in Alberta; the alternate food-plant is Douglas fir (*Pseudotsuga menziesii*). The complete polymorphic cycle [*cf. R.A.E.*, A **4** 523; **10** 605] was observed on the eastern slopes of the Rocky Mountains at an altitude of 4,500 ft. in 1955–57, and the following is based on the author's summary of the results.

The fundatrix overwinters as a nymph on spruce, maturing in spring after 2–3 months and depositing 90–352 eggs. The resulting nymphs move to the new growth, on which galls are formed, but the prior feeding of the fundatrix on the twig seemed essential for the initiation of gall formation. The nymphs passed through four instars, and the adult gallicolae migrated to *P. menziesii*, on which they oviposited. Their progeny (sistentes) overwintered as nymphs on the needles of *P. menziesii* and gave rise to winged sexuparae, which returned to spruce, and wingless progredientes, which remained on *P. menziesii*. The sexuparae gave rise to males and females, which paired, and eggs were laid at the nodes of spruce. The various stages in the cycle are described, and factors of natural control are briefly discussed; the most important was winter cold, which killed many of the sistentes.

Lindquist (O. H.). **A key to the larvae of leaf-mining sawflies on birch in Ontario with notes on their biology.**—*Canad. Ent.* **91** no. 10 pp. 625–627, 3 figs., 6 refs. Ottawa, 1959.

The leaves of birch in Ontario are mined by three sawflies, *Fenusa pusilla* (Lep.), *Profenusa alumna* (MacGill.) and *Heterarthrus nemoratus* (Fall.) and a key to the larvae is given, together with notes on habits.

Lafrance (J.) & Perron (J. P.). **Notes on life-history of the onion maggot,** *Hylemya antiqua* **(Meig.) (Diptera: Anthomyiidae), in sandy and organic soils.**—*Canad. Ent.* **91** no. 10 pp. 633–638, 11 refs. Ottawa, 1959.

The following is based almost entirely on the authors' summary. Field studies from 1955 to 1958 on *Hylemyia antiqua* (Mg.) in onion fields on

sandy and organic soils in south-western Ontario indicated that the earliest dates of emergence from overwintered pupae were between 11th and 26th May, when apple trees were at the pink-bud stage. On both soil types, adults of the first generation began to emerge between 25th June and 9th July, with a peak in the first or second week of July; adults of the second generation began to emerge between 16th and 27th August, with a peak in the last week of August or the first week of September. There were three partial generations a year in 1956–1958, but the first generation was complete in 1955. During the four years, the percentages of pupae that entered diapause were 3 for the first generation, 71 for the second and 100 for the third in sandy soil, and 20, 68 and 100, respectively, in organic soil. When the average temperature during pupation was over 70°F., fewer pupae entered diapause. Higher average monthly temperature accelerated pupal development and hastened adult emergence.

Ives (W. G. H.) & Turnock (W. J.). **Estimation of cocoon populations of the larch sawfly, *Pristiphora erichsonii* (Hartig).**—*Canad. Ent.* **91** no. 10 pp. 650–661, 5 figs., 7 refs. Ottawa, 1959.

In this paper, which is one of a series on techniques used in estimating populations of *Pristiphora erichsonii* (Htg.) on larch in Canada [*cf. R.A.E.*, A **45** 179; **48** 522], two methods of estimating the cocoon population are considered. The first was soil sampling, and it appeared that a random procedure was satisfactory, though a stratified one based on the position of the sampling unit in relation to the crowns and topography reduced the size of the samples required. The other method was the trapping of falling larvae beneath the trees by means of funnels that led them into metal boxes containing moss for cocoon formation. These resulted in larger population estimates since they permitted counts of the total number of cocoons found, and this method was considered more satisfactory than soil sampling. Random sampling was satisfactory in pure stands, though a stratified method based on crown cover might be necessary in mixed stands or open pure stands.

Downes (J. A.). **The gypsy moth and some possibilities of the control of insects by genetical means.**—*Canad. Ent.* **91** no. 10 pp. 661–664, 6 refs. Ottawa, 1959.

It is suggested that use could be made in the control of *Lymantria dispar* (L.) in the United States of the quantitative differences in the male-determining factors of the sex-inheritance mechanism shown by some of the geographic races of this species [*cf. R.A.E.*, A **23** 136], the range of which extends from western Europe eastward to Japan. The male determinants are normally balanced against the female ones in such a manner that the presence of one X-chromosome leads to the development of a normal female and that of two to a normal male. In the progeny from a cross between a race in which the male determinants are strong and another in which they are weak, however, the presence of a single X-chromosome leads to the development of an intersex or even of a male. The male determinants are strong in races in eastern Asia and display varying degrees of weakness in European races. The population in the United States originated in France, and if a female is mated with a male of a strong race, the male progeny will be normal and fertile and the rest sterile intersexes. It is thought that the liberation in the United States of large numbers of males of a strong race over several generations would lead to the eventual eradication of the established population, and some aspects of such a project are discussed.

Finnegan (R. J.). **The pales weevil, *Hylobius pales* (Hbst.), in southern Ontario.**—*Canad. Ent.* **91** no. 10 pp. 664–670, 3 figs., 16 refs. Ottawa, 1959.

Hylobius pales (Hbst.) is one of a complex of weevils including also *Pissodes approximatus* Hopk. [*cf. R.A.E.*, A **47** 503] that damage young pines in reforestation work and Christmas-tree production in southern Ontario. The literature on it is reviewed [*cf.* **9** 288], and observations on its bionomics begun in 1955 in mixed pine plantations are recorded. It was found that about 70 per cent. of the summer larvae pupate and give rise to adults that feed for a short period in autumn and then overwinter, whereas the remainder overwinter and give rise to adults in summer. The eggs are laid in niches in the inner bark of the roots and in stumps below ground level, and the egg, larval and pupal stages normally last about 10, 47 and 22 days, respectively.

Bradley (G. A.). **Feeding sites of aphids of the genus *Cinara* Curtis (Homoptera: Aphididae) in northwestern Ontario.**—*Canad. Ent.* **91** no. 10 pp. 670–671. Ottawa, 1959.

A table shows the species of conifers and the parts infested at different seasons by 18 species of *Cinara* in north-western Ontario, based on observations in 1957–58.

Dutky (S. R.). **Report on white grub control project in Chile.**—*Agric. téc.* **17** no. 2 pp. 92–105. Santiago, Chile, 1957.

A project to use milky diseases, notably that caused by *Bacillus popilliae*, for the control of the larvae of *Hylamorpha elegans* (Burm.) was begun in Chile, and this report on its progress resulted from a visit by the author in August–October 1956. Numerous suggestions are made, including some for improvement of the techniques in use, evaluation of the effect of *Metarrhizium anisopliae*, a fungus that already affords considerable control, and the use of *Hylamorpha* adults for propagating *B. popilliae*.

Lorca (F. L.). **Experimentos de control del trips de la cebolla (*Thrips tabaci*, Lind).** [Experiments on the control of the onion thrips (*T. tabaci*).]—*Agric. téc.* **18** no. 1 pp. 17–23, 8 refs. Santiago, Chile, 1958. (With a summary in English.)

In the summer of 1956–57, 13 insecticides were tested in sprays for the control of *Thrips tabaci* Lind. on onion in central Chile. The best results were given by 1·8 lb. 50 per cent. wettable dieldrin in about 68 gal. spray per acre, which gave excellent control for 20 days. Toxaphene, BHC and parathion remained effective for ten days. None of these materials damaged the plants.

Herrera Villamil (G.). **Biología y control de la falsa arañita roja de la vid (*Brevipalpus chilensis* Baker).** [Bionomics and control of the false spider mite of vines (*B. chilensis*).]—*Agric. téc.* **28** no. 1 pp. 35–42, 1 fig., 11 refs. Santiago, Chile, 1958. (With a summary in English.)

Brevipalpus chilensis Baker has caused severe injury to vines in Chile in recent years, causing crop losses of 15–20 and even 40 per cent. in some

places. All stages of this mite are briefly described. In observations on its life-history [*cf. R.A.E.*, A **47** 286], carried out at laboratory temperatures of 13–28°C. [57·4–82·2°F.], the egg stage, the active larval, protonymphal and deutonymphal and the moulting larval, protonymphal and deutonymphal stages averaged 12·37, 3, 4·33, 4·8, 2·9, 3·6 and 4·33 days, respectively. There were 5–6 generations a year in the vineyard, of which the last, consisting mainly of females, overwintered beneath the bark of the stems and shoots. Preliminary tests indicated that the adults, which cause most of the damage [*cf. loc. cit.*], are difficult to control by means of acaricides, but field experiments in 1957 showed that sprays of chlorobenzilate or DMC (Dimite) were very effective and laboratory tests that Karathane and Kelthane were about as good.

Knorr (L. C.), Webster (B. N.) & Malaguti (G.). **Injuries in *Citrus* attributed to *Brevipalpus* mites, including *Brevipalpus* gall, a newly reported disorder in sour-orange seedlings.**—*FAO Plant. Prot. Bull.* **8** no. 12 pp. 141–149, 7 figs., 18 refs. Rome, 1960.

The various types of injury caused to *Citrus* in different countries by *Brevipalpus* spp. are reviewed, and a first description is given of galls associated with and probably caused by *B. phoenicis* (Geijskes) on the main stems of sour-orange seedlings in Venezuela; 60 per cent. of the seedlings in one nursery and 15 per cent. of those in another were affected, and the condition terminated in the death of the plants.

Kolmakova (V. D.). **On the biology of Siberian fruit moths of the genus *Grapholitha* (Lepidoptera, Tortricidae), injurious to fruit trees in Transbaikalia.** [*In Russian.*]—*Rev. Ent. URSS* **37** pt. 1 pp. 134–150, 4 figs., 31 refs. Moscow, 1958. (With a summary in English.)

Danilevskiĭ (A. S.). **The species of fruit moths (Lepidoptera, Pyralidae, Carposinidae, Tortricidae) injurious to fruit trees in the Far East.** [*In Russian.*]—*T.c.* pt. 2 pp. 282–293, 4 figs., 19 refs. (With a summary in English.)

In the first of these papers, an account is given of studies carried out in Ulan-Ude, Transbaikalia, in 1949–56 on the bionomics of two species of *Cydia* described by Kozhanchikov in 1953 as *Laspeyresia prunifoliae* and *L. cerasana*, spp. n. [*R.A.E.*, A **43** 197]. The first of them attacks apples, including wild and cultivated forms, and had only one generation a year. The adults appeared in early June, at the beginning of flowering, and were present until August. Eggs were laid singly on the lower surfaces of the leaves at the end of June and on the fruits in early July, and the larvae, which hatched in 5–7 days, fed at first just under the surface of the apples and then attacked the seeds. After 35–40 days, they migrated to the surface of the soil and overwintered in cocoons among dry leaves. Pupation took place in the following May. The other species infests cherries and had two generations a year, the second being incomplete. The adults appeared at the beginning of June and were seen until August, the two generations overlapping. Eggs were laid on the leaves and later on the fruits, and larvae that fed in young fruits in which the seeds were still soft pupated in July and gave rise to the second generation; those that fed in older fruits, in which they were restricted to the pulp, remained in the fruits until harvest, overwintered in the upper 4 in. of soil and pupated in spring.

Wild apricot and plum were also attacked. Dissection showed that females of both species contained some 160–170 eggs each. The relation of the two to other fruit moths is discussed.

It is stated in the second paper that eight species of Tortricids have been recorded as developing in orchard fruits in the Far East of the Soviet Union. Examination of the material on which most of the records were based showed that in reality only three were present. These are *Spilonota* (*Tmetocera*) *prognathana* (Sn.), which damages apples in the Soviet Far East as far west at Transbaikalia, *Cydia* (*Laspeyresia*) *inopinata* (Heinr.) [**16** 576], which attacks wild and cultivated apples throughout the Soviet Far East, and *C.* (*L.*) *funebrana* (Treitschke), which is the principal pest of plums, cherries and apricots from Transbaikalia to the south of the Maritime Province. *C.* (*L.*) *prunifoliae* (Kozhanchikov) is a synonym of *C. inopinata*, and the adult males and females from which *C.* (*L.*) *cerasana* (Kozhanchikov) was described are referable to *C. funebrana* and *C. inopinata*, respectively; the *cerasana* of the first paper is *C. funebrana*. There was no evidence of the presence of *C.* (*Carpocapsa*) *pomonella* (L.) or *C.* (*L.*) *molesta* (Busck), although the former has been found in western Sinkiang [*cf.* **48** 212]. In addition, the Pyralid, *Numonia pirivorella* (Mats.) is a serious pest of pears in the Maritime Province, and *Carposina sasakii* Mats. infests apples, pears, hawthorn [*Crataegus*] and occasionally plums and apricots in the same region [*cf.* **48** 10]. A key is given to the larvae and pupae of the five species found.

Chernova (N. I.). **Characteristics of the behaviour of certain species of lucerne pests and the nature of the injuries they cause.** [*In Russian.*] —*Trud. vsesoyuz. Inst. Zashch. Rast.* **10** pp. 62–79, 7 graphs, 19 refs. Leningrad, 1958.

Observations in the Stalingrad region east of the Volga in 1952–54 showed that the most important pests of lucerne grown for seed there are *Hypera* (*Phytonomus*) *variabilis transsylvanica* (Petri) and *Tychius flavus* Becker, which prefer sowings on dry land, and *Adelphocoris lineolatus* (Goeze) and *Bruchophagus roddi* (Guss.), which chiefly infest irrigated plants. The first two are commonest in dry years and the last two in wet ones. Details are given of investigations on the daily fluctuations in respiration and the relations to temperature, relative humidity and light of individuals of these species in different stages of development.

Gerasenkova (E. D.). **On the resistance of** *Eurygaster integriceps* **Put. to DDT.** [*In Russian.*]—*Trud. vsesoyuz. Inst. Zashch. Rast.* **10** pp. 80–97, 9 graphs, 3 pp. refs. Leningrad, 1958.

The results are given of laboratory studies carried out in 1954–55 on the physiological causes of the fluctuations in the susceptibility of *Eurygaster integriceps* Put. to DDT [*cf. R.A.E.*, A **42** 148, etc.]. Study of the overwintered adults indicated that as the rate of respiration increased with activity and as the reserves of fat were drawn upon for the completion of sexual development, the resistance of the bug rapidly decreased. It is considered that the best time for application of DDT in grain fields is at the beginning of oviposition, after flight from the winter quarters. In experiments, a higher kill of males than of females was obtained [*cf.* **42** 70].

Beglyarov (G. A.). **Species of Phytoseiidae (Parasitiformes, Gamasoidea), predators of Tetranychoid mites in orchards in the Krasnodar region.** [*In Russian.*]—*Trud. vsesoyuz. Inst. Zashch. Rast.* **10** pp. 98–124, 11 figs., 38 refs. Leningrad, 1958.

A key is given to 11 species of Phytoseiid mites, two of which are new, that feed on Tetranychoid mites on fruit trees in the Krasnodar region of the Soviet Union. The adults, ecology and distribution of all of them are described, and the prey of all but one is named. Most belong to the genus *Typhlodromus*. Populations of Tetranychids have risen recently, owing to the use in many orchards of DDT [*cf. R.A.E.*, A **48** 407], which is very toxic to the Phytoseiids.

Berker (J.). **Die natürlichen Feinde der Tetranychiden.** [The natural enemies of Tetranychids.]—*Z. angew. Ent.* **43** pt. 2 pp. 115–172, 17 figs., 85 refs. Hamburg, 1958. (With a summary in English.)

Investigations were carried out near Stuttgart in 1953–55 on the natural enemies of Tetranychids, which have hitherto been little investigated in Germany. The Tetranychids observed included five species injurious to fruit trees, *Panonychus* (*Metatetranychus*) *ulmi* (Koch), *Bryobia praetiosa* Koch [*sens. lat.*], *Tetranychus telarius* (L.) (*urticae* Koch), *T. viennensis* Zacher and *Eotetranychus pruni* Oudm. (*pomi* Sepasgosarian). In all, 59 species of predacious insects or mites were found to feed on them, including some not hitherto known to prey on Tetranychids, but only two, *Stethorus* (*Scymnus*) *punctillum* Weise and *Oligota flavicornis* Erichson, had no other food. A list of the predators is given, followed by details of the bionomics, abundance and effectiveness of the more important of them [*cf. R.A.E.*, A **46** 402–4, etc.], based on field and laboratory observations, and a brief discussion of their natural enemies, rearing methods, and, in particular, the reductions in their numbers caused by insecticidal sprays. A test carried out in 1954 to demonstrate the total effect of the predators on *P. ulmi* showed that covering a tree with a tent and spraying it on 4th June with 0·1 per cent. DDT, which almost eliminated natural enemies, allowed the population of *P. ulmi* to increase to a level about 20 per cent. above that on an unsprayed and unprotected tree. The number of winter eggs laid on the former up to 9th September was about 12·5 times that on the latter. The percentage of winter eggs destroyed in the locality was 18–33 in 1953–54 and 32–46 in 1954–55.

Schneider (H.). **Untersuchungen über den Einfluss neuzeitlicher Insektizide und Fungizide auf die Blutlauszehrwespe (*Aphelinus mali* Hald.).** [Investigations on the effect of modern insecticides and fungicides on *A. mali*.]—*Z. angew. Ent.* **43** pt. 2 pp. 173–196, 11 graphs, 55 refs. Hamburg, 1958. (With a summary in English.)

Investigations were carried out in the Rhine Palatinate in 1955–57 on the effect of modern organic insecticides and fungicides on *Aphelinus mali* (Hald.) parasitising *Eriosoma lanigerum* (Hsm.) on apple [*cf. R.A.E.*, A **49** 45, etc.]. In that area, *A. mali* has several overlapping generations a year and overwinters predominantly in the dead hosts. Examination of mummified examples of *E. lanigerum* collected in the winter of 1955–56 showed that, at the onset of cold weather, last-instar larvae in diapause comprised about 60–70 per cent. and living pupae and adults about 25–40

per cent. of the parasites in them. Almost all the adults and pupae were killed, however, by exceptionally cold weather at the end of January. Pupae (evidently from larvae that had overwintered in diapause) reappeared in numbers from 11th April.

To test the effect of diapause on the susceptibility of the larvae to insecticides, twigs brought from the field at the end of October 1955 and bearing mummified hosts in which last-instar parasite larvae (in diapause) predominated, and parasite material reared in the laboratory (mainly in the last instar but not in diapause), were immersed for 10 seconds in liquids containing 0·035 per cent. parathion or 0·1 per cent. methyl-demeton (Metasystox). The insecticides caused 40 and 0 per cent. mortality, respectively, of the field material (and practically all that following treatment with parathion was of pupae and adults) and 65 and 25 per cent. mortality, respectively, of the laboratory material, whereas in the untreated controls, the mortality percentages were 15 for the field material and 5 for the laboratory insects; diapause evidently protected against the effects of the toxicants. In similar tests with winter-spray preparations, twigs bearing mummified hosts were dipped and kept in the open under shelter. After nine weeks, mortality of parasites was lowest (15·8 per cent.) for an emulsion spray of DNC in mineral oil and was nearly always lower than in the controls (in which it was 50 per cent.). The dead parasites consisted predominantly of adults and pupae, and larvae, all of which had probably been killed by disease, comprised at most about 15 per cent. of the population. When the same products were applied in sprays in the field on 5th March 1956, parasite mortality four weeks later in the mummified hosts ranged from 32 to 51·8 per cent., being lowest for DNC, as compared with 36 per cent. in the controls, and a maximum of probably not more than 6 per cent. comprised larvae that had been killed by the sprays. That the insecticides, as well as cold weather, were responsible for the higher mortality of pupae and adults was confirmed in a further laboratory test in which twigs bearing artificially parasitised aphids containing pupae and adults of *A. mali* were dipped in the same products. Mortality ranged from 0 to 100 per cent., being lowest for DNC, followed by dinoseb, and these are therefore recommended for use in winter sprays against *E. lanigerum*.

In tests with summer sprays, mummified aphids collected in the field were sprayed with 0·2 per cent. DDT, 0·3 per cent. γ BHC (lindane), 0·035 per cent. parathion, 0·1 per cent. methyl-demeton or 0·4 per cent. lead arsenate. Parasite mortality ranged from 3·4 to 12·8 per cent., as compared with 13·8 per cent. in the controls. The effect of these products and 0·2 per cent. toxaphene on the parasite before, during and just after emergence of the adult from the host was then investigated. When field-collected material was dipped, mortality was highest for parathion and in all cases higher than in the controls. Mortality during and after adult emergence was rather greater for DDT than for the other products and was very low for lead arsenate and toxaphene; much of the high mortality before emergence was probably due to natural causes. When laboratory-reared material was dipped, similar results were obtained and γ BHC and parathion were found to be considerably more toxic to the immature stages than to the adults. Similar tests with various fungicides showed that they had no effect at normal concentrations on immature stages in the dead hosts.

To determine the effect of the summer sprays already tested (and also one of 0·1 per cent. diazinon) on the free adults, trees were sprayed (and covered for protection against precipitation) and adults exposed to the treated leaves after various periods. All sprays except lead arsenate caused complete mortality one day after application. All caused complete mortality

five days after application except methyl-demeton, which had no effect, and toxaphene, which caused only slight kill, but only DDT resulted in complete kill after ten days; the effect of DDT persisted for up to 23 days. When the sprayed trees were left uncovered, only DDT showed any appreciable action after four days, all the other materials except parathion having completely lost their toxicity. Further observations were made in June–July 1957, on trees sprayed against *Cydia* (*Carpocapsa*) *pomonella* (L.). After treatment with DDT, γ BHC, parathion and diazinon, adults of *A. mali* were almost eliminated. Parasitism of *E. lanigerum* decreased sharply, and the effect was long-lasting in the case of DDT, somewhat less so for γ BHC and of short duration for the other two. Lead arsenate had no effect. Methyl-demeton, tested in one series only, resembled parathion in its effects, and fungicides proved harmless.

Titschack (E.) & Wodsak (W.). **Über unentbehrliche Wirkstoffe bei der Aufzucht der Kleidermotte.** [Indispensable materials in the rearing of *Tineola bisselliella*.]—*Z. angew. Ent.* **43** pt. 2 pp. 197–207, 3 refs. Hamburg, 1958. (With a summary in English.)

Pure wool processed for textile purposes proved unsuitable for rearing larvae of *Tineola bisselliella* (Humm.), but the addition to it of extracts of horse dung and yeast rendered it suitable. Chemical treatment of the extracts yielded a more concentrated material, but the factor responsible for the effect could not be identified.

Buhl (C.) & Waede (M.). **Ein Versuch zur Bekämpfung von Rapsschädlingen, insbesondere des Rapsglanzkäfers** (*Meligethes* **sp.), mit Hilfe eines Flugzeugeinsatzes.** [A test on the control of rape pests, in particular of *Meligethes* sp., with the help of treatment from the air.]—*NachrBl. dtsch. PflSchDienst* **10** no. 5 pp. 74–78, 2 figs., 7 refs. Stuttgart, 1958.

In a test in Schleswig-Holstein in 1957, populations of *Meligethes* sp., on rape were greatly reduced by a spray containing toxaphene applied from the air on 14th May, when adult activity was at its maximum, but damage to the inflorescences was not reduced and it appeared that the adults had already caused considerable injury before the flowers opened [*cf. R.A.E.*, A **44** 253; **47** 275]. The spray did not control *Ceutorhynchus assimilis* (Payk.).

Müller (H. W. K.). **Zur Bekämpfung der Erdbeermilbe** (**Cyclamenmilbe**) *Stenotarsonemus pallidus* (**Banks 1901**), **4. Beitrag.** [On the control of *S. pallidus*, 4th contribution.]—*NachrBl. dtsch. PflSchDienst* **10** no. 6 pp. 82–87, 19 refs. Stuttgart, 1958. (With a summary in English.)

Endrin and Hostatox [polychloroendomethylenetetrahydroindene] are the the best acaricides for the control of *Stenotarsonemus pallidus* (Banks) on strawberry in Germany, but their use before flowering is undesirable owing to lasting deposit or persistent odour. Tests in 1956–57 of materials for application before flowering showed that an emulsion spray of Kelthane gave good control and lacked the deleterious side effects of the other two. It is recommended that two applications, at an interval of 10 days, should be made either before or before and after flowering.

Klemm (M.). **Das Auftreten des Schattenwicklers** (*Cnephasia wahlbomiana* **L.) in Süddeutschland.** [The occurrence of *C. virgaureana* in southern Germany.]—*NachrBl. dtsch. PflSchDienst* **10** no. 11 pp. 167–170, 2 maps, 42 refs. Stuttgart, 1958.

Clover, lucerne and beet were infested by *Cnephasia virgaureana* (Treitschke) (*wahlbomiana*, auct.) in 58 districts of Bavaria and Baden in 1954 and in 54 in these regions and the Rhine Palatinate in 1957 (the majority in Bavaria in both years), and the localities are shown on maps. Infestation increased in many places during the intervening period, but the Tortricid is unlikely to become of great importance.

Fritzsche (R.) & Hoffmann (G. M.). **Befall der Imagines von** *Aphthona euphorbiae* **Schrk. und** *Longitarsus parvulus* **Payk. durch** *Entomophthora* **sp. (Coleoptera: Halticidae; Entomophthoraceae).** [Infestation of adults of *A. euphorbiae* and *L. parvulus* by *Entomophthora* sp.]—*Beitr. Ent.* **9** no. 5–6 pp. 517–523, 4 figs., 6 refs. Berlin, 1959. (With summaries in English & Russian.)

Adults of the flax flea-beetles, *Aphthona euphorbiae* (Schr.) and *Longitarsus parvulus* (Payk.), were found in the field and laboratory in eastern Germany in 1958, particularly in May and June, to be infested by *Entomophthora* sp. The symptoms are described, and it is stated that the percentage of beetles affected in some flax fields reached 90 per cent.

Fritzsche (R.). **Beiträge zur Biologie, Ökologie und Bekämpfung der Leinerdflöhe.** [Contributions to the biology, ecology and control of the flax flea-beetles.]—*NachrBl. dtsch. PflSchDienst* (N.F.) **12** pt. 7 pp. 121–133, 8 figs., 12 refs. Berlin, 1958. (With summaries in English & Russian.)

The flea-beetles, *Apthona euphorbiae* (Schr.) and *Longitarsus parvulus* (Payk.), cause widespread damage to flax in central Germany, where numbers sometimes reach outbreak proportions, and the detailed results are given of investigations on their bionomics, ecology and control carried out in 1955–57. Considerable injury was sometimes caused both by the adults, which fed on the stems and leaves and overwintered at the edges of forests, and by the larvae, which fed on the root tips. Soil treatment with γ BHC (lindane) at 90 lb. per acre before sowing (which should be carried out early) gave the best control, but supplementary treatment of the plants with a DDT dust may be required if the adults become numerous.

Zech (E.). **5 jährige Untersuchungen über den Schlupfverlauf von** *Carpocapsa pomonella* **L. mit besonderer Berücksichtigung der 2.Generation.** [Five years of investigations on the course of adult emergence of *Cydia pomonella*, with particular reference to the first generation.]—*NachrBl. dtsch. PflSchDienst* (N.F.) **12** pt. 8 pp. 143–150, 5 graphs, 27 refs. Berlin, 1958. (With summaries in English & Russian.)

The following is based on the author's summary of this account of investigations on the number and times of flight of the generations of *Cydia* (*Carpocapsa*) *pomonella* (L.) on apple and pear near Naumburg, eastern Germany, in 1953–57. In the investigations on apple, the first adults emerged from the overwintered cocoons between 17th May and

5th June (usually in June), and the earliness of emergence generally increased with the average temperature in April–May. First-generation larvae gave rise to the first summer adults between 15th July and 11th August, the percentage transforming in the same year ranging from 0·7 to 9·6 and the date of emergence varying with that of the overwintered generation. Emergence continued until the end of August in cool years. In the investigations on pear, first-generation larvae entered trap-bands for overwintering or pupation some 7–10 days later than on apple and it appeared that a second generation developed only in the warmest two years.

Fröhlich (G.). **Der Einfluss der Umwelt auf den Massenwechsel und die Massenvermehrung der Luzerneblütengallmücke** *Contarinia medicaginis* **Kieff.** [The effect of external influences on population changes and mass increase of *C. medicaginis*.]—*NachrBl. dtsch. PflSchDienst* (N.F.) **12** pt. 9 pp. 161–172, 9 figs., 17 refs. Berlin, 1958. **Möglichkeiten und Methoden zur Prognose und Kontrolle eines Massenauftretens der Luzerneblütengallmücke** *Contarinia medicaginis* **Kieff.** [Possibilities and methods of the prognosis and control of an outbreak of *C. medicaginis*.]—*T.c.* pt. 10 pp. 181–187, 5 figs., 11 refs. (With summaries in Russian & English.)

The investigations recorded in these two papers on *Contarinia medicaginis* Kieff. infesting lucerne were carried out near Leipzig in 1954–57. Those described in the first, on the effect of environmental factors on changes in population of this Cecidomyiid [*cf. R.A.E.*, A **27** 457], showed that temperature and precipitation were the most important. Outbreaks occurred only when temperatures at 5 p.m. on or immediately beneath the surface of the soil were not below 16°C. [60·8°F.] and the minimum and maximum air temperature in the plant stand had not fallen below 8 and 20°C. [46·4 and 68°F.], respectively, for 10–20 days. When these conditions were fulfilled, an outbreak would be likely if the total precipitation from March to June exceeded about 8 in. Older or closely planted crops and crops growing in loam soil were favourable for the midges, but the edges of crops exposed to winds had a somewhat reduced infestation. Insolation [*cf. loc. cit.*], type of lucerne and insect parasites appeared to be unimportant.

Although the weather is the decisive factor in the time of mass emergence of the adults, various other long- and short-term methods of forecasting the time and intensity of flights are discussed in the second paper. Intensity can be predicted by counts of larvae and puparia in the soil, and the date by correlation of flight with the phenology of certain other insects and plants and by afternoon net catches, but the adults were not significantly attracted to yellow or white trap-dishes.

Falk (U.). *Aphis craccivora* **Koch—eine Doppelgängerin der Schwarzen Bohnenlaus.** [*A. craccivora*—a 'double' of *A. fabae*.]—*NachrBl. dtsch. PflSchDienst* (N.F.) **12** pt. 10 pp. 187–189, 7 refs. Berlin, 1958. (With summaries in Russian & English.)

Damage to broad beans (*Vicia faba*) near Rostock in the summer of 1957 resembling that caused by *Aphis fabae* Scop. was found to be caused by *A. craccivora* Koch. This is stated to be the first record of damage to *V. faba* by this aphid in Europe, but it has probably been confused with *A. fabae* in the past. Characters are given distinguishing the adult apterae and alates of the two species.

Masurat (G.). **Weitere Beobachtungen zur Biologie der Ampferblattwespe** *Ametastegia glabrata* **Fall.** [Further observations on the bionomics of *A. glabrata.*]—*NachrBl. dtsch. PflSchDienst* (N.F.) **12** pt. 10 pp. 192–193, 1 fig., 7 refs. Berlin, 1958.

Larvae of *Ametastegia glabrata* (Fall.), which frequently enter apples to overwinter [*cf. R.A.E.*, A **42** 235], were found to have hibernated in the twigs of cherry near Altenburg, eastern Germany, in April 1957.

Hahn (E.). **Untersuchungen über die Fritfliege am Mais anlässlich eines starken Auftretens im Jahre 1958.** [Investigations on *Oscinella frit* on maize in connection with a severe outbreak in 1958.]—*NachrBl. dtsch. PflSchDienst* (N.F.) **12** pt. 11 pp. 201–209, 13 figs., 26 refs. Berlin, 1958. (With summaries in Russian & English.)

Infestation of sweet maize by a Chloropid thought to be *Oscinella* (*Oscinis*) *frit* (L.) occurred throughout eastern Germany in 1958 and was considerable in some places. The nature of the injury is described in detail. Young plants or plants retarded in development were the worst affected, and it appeared that damp, cool weather in spring had accelerated the growth of the cereals normally infested, rendering them unsuitable for oviposition and feeding, but had retarded that of the maize, which, being still tender, was susceptible to attack.

Schmidt (H.). **Der Massenwechsel der Vektoren der virösen Rübenvergilbung in den Jahren 1954 bis 1957 in Aschersleben.** [Population fluctuations of the vectors of virus yellows of beet in 1954–57 in Aschersleben.]—*NachrBl. dtsch. PflSchDienst* (N.F.) **12** pt. 11 pp. 209–217, 12 graphs, 28 refs. Berlin, 1958. (With summaries in Russian & English.)

Observations were made in 1954–57 at Aschersleben, in central Germany, on the fluctuations in numbers of *Aphis* (*Doralis*) *fabae* Scop. and *Myzus persicae* (Sulz.) on sugar-beet and the transmission by them of the beet-yellows virus. Infestation was severe in 1954 and 1956, but slight in 1955 and 1957, and *A. fabae* was the more numerous of the two aphids. A yearly summer peak in numbers was followed by a considerable fall in the population, evidently due to migration of the alates, and this was followed by a further peak in autumn. The species were probably about equally important in transmitting the virus.

Müller (W.). **Auftreten der Spinnmilbe** *Brevipalpus oudemansi* **Geijskes in Mitteldeutschland.** [Occurrence of *Cenopalpus pulcher* in central Germany.]—*NachrBl. dtsch. PflSchDienst* (N.F.) **12** pt. 11 pp. 217–218, 8 refs. Berlin, 1958.

Cenopalpus pulcher (C. & F.) (*Brevipalpus oudemansi* (Geijskes)) [*R.A.E.*, A **48** 150], which was recorded from south-western Germany in 1951 [**43** 21], was found on apple, pear and cherry near Aschersleben, central Germany, in the winter of 1957–58.

Buhl (K.). **Beobachtungen und Untersuchungen über Biologie und Bekämpfung des Rapserdflohes** (*Psylliodes chrysocephala* **L.) in Schleswig-Holstein.** [Observations and investigations on the bionomics and control of the rape flea-beetle *P. chrysocephala*, in Schleswig-Holstein.]—*Z. PflKrankh.* **66** pt. 6 pp. 321–338, 4 figs., 24 refs. Stuttgart, 1959. (With a summary in English.)

The following is based on the author's summary. Observations on the bionomics of *Psylliodes chrysocephala* (L.) and its injuriousness to cruciferous crops in Schleswig-Holstein in 1949–58 are described. The flea-beetle has only one generation a year in this region, and the larvae mainly attack winter rape, turnips being sown too late in autumn to be much damaged. Injury increases with the population of third-instar larvae in autumn and is considerably increased by severe frost in the absence of snow cover, but ploughing an infested crop under then is dangerous, since the larvae may attack other crops in spring, and a further crop sown in autumn may be destroyed as seedlings by larvae from eggs already in the soil.

The females lay 800–1,000 eggs each in the field, and eggs that have not hatched when frost occurs overwinter and hatch in the following spring. Few of the adults hibernate, the percentage varying from 5 to 18. Parasites afford less than 1 per cent. control.

Cultural measures are effective against the larvae, and it was found that treatment of the seed with γ BHC (lindane) at 10 per cent. of its weight reduced the attack to economic levels, though it did not afford complete protection.

Godan (D.). **Untersuchungen über den Einfluss organischer Phosphorpräparate auf das Verhalten von Insekten.** [Investigations on the effect of organic phosphorus preparations on the behaviour of insects.]—*Z. PflKrankh.* **66** pt. 6 pp. 338–353, 4 figs., 12 refs. Stuttgart, 1959. (With a summary in English.) (English translation available.)

The following is based on the author's summary. Since laboratory and field experiments showed that deposits of organophosphate insecticides have not only a toxic effect on insects but also an attractive or repellent effect depending on concentration, parathion, diazinon and demeton were tested against insects of various species in percentage concentrations decreasing from 1 to 10^{-6}. It was found that the higher concentrations were uniformly repellent, but that this effect decreased with concentration to a point at which it disappeared. Below this, attractiveness set in and increased to a maximum, beyond which it decreased to zero. The curves were characteristic for each insecticide and insect species and stage, but were in general parallel.

Philipp (W.). **Blausäure gegen Johannisbeergallmilbe** (*Eriophyes ribis* **Nal.).** [Hydrogen cyanide against *Cecidophyes ribis.*]—*Z. PflKrankh.* **66** pt. 6 pp. 353–354. Stuttgart, 1959. (With a summary in English.)

Tests in Germany showed that *Cecidophyes* (*Eriophyes*) *ribis* (Westw.) on black-currant bushes in the open was completely controlled by fumigation for 30 minutes under covers with hydrogen cyanide (generated from calcium cyanide) applied at the rate of 1 oz. per 100 cu. ft. at 4°C. [39·2°F.].

Schönherr (J.). **Biologie und Morphologie von** *Ectoedemia liebwerdella* **Zimmerm., unter Berücksichtigung der übrigen rindenminierenden Nepticuliden (Lep.).**—[Bionomics and morphology of *E. liebwerdella*, with consideration of the other bark-mining Nepticulids.]—*Dtsch. ent. Z.* (N.F.) **5** pt. 1–2 pp. 1–71, 61 figs., 32 refs. Berlin, 1958.

Most Nepticulids mine the leaves of their food-plants, but some mine in the bark. One such is *Ectoedemia liebwerdella* Zimmermann, which was found on beech (*Fagus sylvatica*) near Tharandt in 1954. All stages of the species are described, and observations on its bionomics are recorded in detail, with descriptions of the mines. Its economic importance is uncertain, for although it attacks healthy trees and the larvae feed for some 22 months, tree mortality may be due to secondary causes.

Niechziol (W.). **Biologisch-ökologische Studien zur Kalamität der Kleinen Fichtenblattwespe (*Lygaeonematus pini* Retz.) im Mooswald bei Freiburg.** [Biological-ecological studies on an outbreak of *Pristiphora abietina* in Mooswald near Freiburg.]—*Dtsch. ent. Z.* (N.F.) **5** pt. 1–2 pp. 98–179, 35 figs., 68 refs. Berlin, 1958.

Details are given of an outbreak of *Pristiphora abietina* (Christ) (*Lygaeonematus pini* (Retz.)) on spruce near Freiburg im Breisgau that began towards the end of the late war and had caused great losses by 1950. It apparently resulted from a progressive drying of the soil, which facilitated pupation of the sawfly larvae [*cf. R.A.E.*, A **48** 158].

Luitjes (J.). **Over de economische betekenis van insektenplagen in bossen (*Cephalcia alpina* Klug en *Diprion pini* L.).** [On the economic significance of insect pests in forests (*C. alpina* and *D. pini*).]—*Versl. Landbouwk. Onderz.* no. 64.8, [4+] 56 pp., 11 figs., 3 pp. refs. The Hague, 1958; also as *Meded. Inst. toegep. biol. Onderz. Nat.* no. 40. Arnhem, 1958. (With a summary in English.)

This is an account of investigations in Holland in 1952–56 on the losses caused by an outbreak of *Cephalcia alpina* (Klug) on Japanese larch [*Larix leptolepis*] in 1941–50 [*cf. R.A.E.*, A **48** 399] and one of *Diprion pini* (L.) on Scots pine [*Pinus sylvestris*] in 1950–51.

Veenenbos (J. A. J.). **Zaadbehandeling met lindaan ter bestrijding van aardvlooien bij vlas.** [Seed treatment with lindane for control of flea-beetles on flax.]—*Landbouwvoorlichting* **14** no. 3 pp. 142–146, 1 fig. The Hague, 1957. (With a summary in English.)

In field tests in Holland in 1956, flax seedlings were protected from injury by the flea-beetles, *Aphthona euphorbiae* (Schr.) and *Longitarsus parvulus* (Payk.), by treatment of the seed with γ BHC (lindane) at 2·7–4·4 oz. 20 per cent. powder per bushel, the insects dying in the greenhouse within two days of feeding on them. Seedling emergence was decreased by the γ BHC if TMTD [thiram] was not added to it.

Kirkov (K.). **New possibilities in the control of the flax flea-beetle (*Aphthona euphorbiae* (Schr.)).** [*In Bulgarian.*]—*Bull. Pl. Prot.* **7** no. 3–4 (15–16) pp. 61–74, 2 figs., 7 refs. Sofia, 1958. (With summaries in Russian & English.)

In experiments in northern Bulgaria in 1955–57 on the use of BHC as a systemic insecticide against *Aphthona euphorbiae* (Schr.) on flax, a preparation containing 12 per cent. BHC was applied to the seed at 2, 4 and 6 lb. per 100 lb. or to the soil at 18, 36 and 54 lb. per acre before sowing. Both methods reduced attack on the stalks. Plots treated by the first gave yields about 72–162 lb. per acre higher and those by the second about 198–315 lb. per acre higher than the controls.

Coulon (J.). **Efficacités comparées de quelques produits acaricides.**—*Phytiat.-Phytopharm.* **7** no. 3–4 pp. 127–132, 1 fig. Paris, 1958.

In the laboratory investigations described, various acaricides were tested against the eggs and adults of *Tetranychus telarius* (L.) in sprays applied to leave 5 mg. liquid per sq. cm. Newly laid eggs were sprayed on the leaves on which they had been deposited and were then kept at about 22°C. [71·6°F.] and 85 per cent. relative humidity, in which conditions hatching began in three days and was complete three days later. Mortality was calculated after seven days by Abbott's formula [*cf. R.A.E.*, A **13** 331], and the LD50's, in μg. actual toxicant per 100 sq. cm., were determined. They were 4·31 for Tedion, 18·1 for phenkapton, 47·3 for chlorobenzilate, 50·6 for Kelthane, 79·4 for chloropropylate (isopropyl p,p′dichlorobenzilate) [**46** 138, 140; **48** 110], 108 for chlorfenson, 151 for fenson, 190 for O,O-diethyl S-(isopropylcarbamoyl)methyl phosphorodithioate (Fac 20), 242 for mevinphos (Phosdrin), 323 for Aramite (2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite), >631 for phosphamidon, >375 for parathion and >389 for endothion. The deposits of Tedion, fenson and chlorfenson killed all the larvae that hatched from treated eggs, the first two at a rate of application equal to twice the LD50 and the third at six or more times its LD50. Parathion, endothion and phosphamidon were much more active against the larvae than against the eggs, endothion killing them at a relatively low dose. Phenkapton was about equally effective against both stages. Adults were confined for 24 hours on leaves that had been sprayed with nine of the materials and allowed to dry, and mortality was calculated as before. The LD50's in μg. per sq. cm. were 1 for Fac 20, 2·9 for endothion, 3·2 for phosphamidon, 3·7 for phenkapton, 5·8 for mevinphos, 9·7 for chloropropylate, 12·1 for parathion, 16·2 for Kelthane and 17·3 for chlorobenzilate. The most effective also acted as strong repellents, but the subsequent behaviour of the mites repelled was not studied. Doses that killed the females did not prevent oviposition.

Coutin (R.) & Hennequin (J.). **Contribution préliminaire à l'étude de l'action de l'endothion sur les larves de la mouche de l'asperge (*Platyparea poecilоptera* Schr.).**—*Phytiat.-Phytopharm.* **7** no. 3–4 pp. 145–150, 2 figs., 8 refs. Paris, 1958.

In tests of new insecticides for the control of *Platyparea poecilоptera* (Schr.) on asparagus in central France in 1958, endothion gave promising results. Since the eggs of this Trypetid are laid in the stems, uninfested shoots of plants in full production [*cf. R.A.E.*, A **47** 110] were caged a

few days after they appeared above the soil, and females were released in the cages. Endothion sprays were applied at intervals against the resulting larvae. They caused complete kill of first- and second-instar larvae in four days 5–6 and again 18 days after treatment and gave at least 85 per cent. mortality between these dates, but were ineffective against larvae in the third instar, though they appeared to retard their movement down the shoots. For the best results, treatment needs to be repeated at intervals not exceeding the duration of the egg stage and the first two instars.

Hurpin (B.). **Sur la virulence de** *Bacillus popilliae* **Dutky pour les larves du hanneton commun** (*Melolontha melolontha* **L.**).—*C.R. Soc. Biol.* **151** (1957) no. 11 pp. 1833–1835, 4 refs. Paris, 1958.

In view of observed similarities in the morphology of *Bacillus popilliae*, which causes milky disease of *Popillia japonica* Newm. in the United States [*cf. R.A.E.*, A **35** 389], and the bacterium that causes a similar disease of *Melolontha melolontha* (L.) in France [*cf.* **45** 454; **46** 468], as well as in their characteristic symptoms and the difficulties experienced in inducing them to sporulate in artificial media, their possible relationship was investigated, with *M. melolontha* as test insect, in the laboratory in France. In attempts to infect larvae with *B. popilliae* by ingestion, a commercial dust preparation of the spores and a suspension prepared by washing dried smears of haemolymph from diseased larvae of *P. japonica*, both applied to the soil, and the provision of slices of carrot that had been soaked for 15 hours in a similar suspension prepared from smears made two years previously were all ineffective, but 56 of 58 third-instar larvae inoculated with a suspension of spores of *B. popilliae* developed typical symptoms and died within a month; a suspension prepared from two of these diseased larvae infected all of 20 larvae into which it was injected in one experiment and killed 12 of 20 in the other, and a suspension prepared in turn from these larvae gave similar results. *B. popilliae* appears to resemble the French bacterium in virulence to *M. melolontha*, and this was confirmed when 23 of 25 larvae into which a suspension of spores of the French bacterium was injected developed symptoms in 14–30 days. The early failures to induce infection by *B. popilliae* by ingestion were probably due to poor preservation of the stocks used; *Melolontha* larvae can be more easily infected in this way with the French than with the American disease. It is concluded that *B. popilliae* induces a disease in *M. melolontha* similar to the milky disease of *P. japonica* and to the milky disease that has been found affecting them in the field in Europe.

Biliotti (E.) & Delanoue (P.). **Contribution à l'étude biologique d'***Opius concolor* **Szepl. (Hym. Braconidae) en élevage de laboratoire.**—*Entomophaga* **4** no. 1 pp. 7–14, 8 figs., 23 refs. Paris, 1959. (With a summary in English.)

A method of rearing *Opius concolor* Szépl. on *Ceratitis capitata* (Wied.) in the laboratory is described. At 24–25°C. [75·2–77°F.], the *Opius* females readily oviposited in third-instar *Ceratitis* larvae, several eggs being laid in some, and the parasite larvae hatched in 24 hours. The larval and pupal stages lasted 6–10 and 6–15 days, respectively. The adults, which emerged from the host puparia, lived for 15–20 days, and the females successfully gave rise to a new generation in *Dacus oleae* (Gmel.) [*cf. R.A.E.*, A **48** 81–82].

Lysenko (O.). **Report on diagnosis of bacteria isolated from insects (1954–1958).**—*Entomophaga* **4** no. 1 pp. 15–22, 16 refs. Paris, 1959. (With a summary in French.)

Lists are given of the bacteria isolated from insects of 20 species, including several well-known plant pests, in the laboratory in Czechoslovakia in 1954–58, with notes on the circumstances in which they were found.

Kramer (J. P.). **Observations on the seasonal incidence of microsporidiosis in European corn borer populations in Illinois.**—*Entomophaga* **4** no. 1 pp. 37–42, 1 map, 5 refs. Paris, 1959. (With a summary in French.)

Investigations in the central maize belt of Illinois in 1954–57 on seasonal fluctuations in the incidence of infection of *Ostrinia* (*Pyrausta*) *nubilalis* (Hb.) by *Perezia pyraustae* [*cf. R.A.E.*, A **48** 362, etc.] showed that infection was higher in autumn than in spring and that mortality due to it was greatly increased by extremes of temperature.

Labeyrie (V.). **Technique d'élevage de** *Chelonus contractus* **Nees. Parasite de** *Phthorimea ocellatella* **Boyd.**—*Entomophaga* **4** no. 1 pp. 43–46, 20 refs. Paris, 1959. (With a summary in English.)

Chelonus contractus (Nees), a Braconid parasite of the eggs of *Gnorimoschema* (*Phthorimaea*) *ocellatella* (Boyd) in south-eastern France, was successfully reared in eggs of *G. operculella* (Zell.) by a modification of the technique used by the author for rearing *Macrocentrus ancylivorus* Rohw. on the same host [*R.A.E.*, A **47** 362]. The females were provided with eggs instead of larvae, and the process was easier because the progeny consisted entirely of females. At 27°C. [80·6°F.], the life-cycle lasted 30–35 days, according to the age of the host eggs.

Musil (M.). **Übertragung des Stolburvirus durch die Zikade** *Euscelis plebejus* **(Fallen).** [Transmission of the stolbur virus by the Cicadellid, *E. plebeja*.]—*Biológia* **14** no. 6 pp. 410–417, 1 graph, 12 refs. Bratislava, 1959. (With summaries in Russian & Czech.)

Details are given of experiments in Czechoslovakia in 1958 in which the stolbur virus was transmitted from *Trifolium repens* (white clover) to *T. pratense* (red clover), *T. hybridum*, *Chrysanthemum carinatum*, *Senecio vulgaris*, *Taraxacum officinale*, *Bellis perennis*, *Callistephus chinensis* (China aster), *Vinca rosea*, *Capsella bursa-pastoris*, *Reseda lutea* and *Stellaria media* by *Euscelis plebeja* (Fall.) [*cf. R.A.E.*, A **48** 275, etc.]. The incubation period in the plants was usually 18–24 days, but occasionally more than a month. The symptoms in the various plants are described.

Jasič (J.) & Bírová (H.). **Plodnosť spriadača amerického** (*Hyphantria cunea* **Drury) a jej stanovenie. I.** [The fecundity of *H. cunea* and its determination. I.]—*Biológia* **13** pt. 11 pp. 793–809, 5 graphs, 20 refs. Bratislava, 1958.

Jasič (J.). **II.**—*Op. cit.* **14** pt. 8 pp. 579–590, 2 graphs, 7 refs. 1959. (With summaries in Russian & German.)

It is stated in the first part of this paper, in which are recorded the results of investigations on the fecundity of *Hyphantria cunea* (Dru.), carried out in eastern Czechoslovakia in 1956, that the fecundity of the females of the summer generation is positively correlated with their weight and with the weight of the pupae from which they were derived, though this decreases during development. It is affected by the plants on which the larvae feed, white mulberry [*Morus alba*] and maple [*Acer*] being the most favourable, and by developmental temperature, the largest average number of eggs laid (916 per female) occurring at 26°C. [78·8°F.] The average number of eggs per female under local field conditions is estimated to be 450–800.

Observations on the overwintering generation, described in the second part, showed that the weight of the autumn pupae was lower than that of the summer ones and that the fecundity of the resulting females was also lower. Fecundity was correlated with the weight of the females themselves and with the weight of the pupae from which they developed, both before and after these had overwintered. A formula for determining the annual development potential for a species having two generations a year is given.

Krístek (J.). **Poznámky k bionomii a ke kontrole pilatky proužkované** (*Pachynemátus scutellatus* (**Htg.**)). [Notes on the bionomics of *P. scutellatus* and methods of studying them.]—*Acta Univ. Agric. Silv.* (C) 1958 pt. 1 pp. 57–74, 2 pls., 6 figs., 5 graphs, 12 refs. Brno, 1958. (With summaries in German & Russian.)

This paper, which is part of a series [*cf. R.A.E.*, A **47** 43], contains the results of observations on the bionomics of the larvae and pupae of *Pachynematus scutellatus* (Htg.) on spruce in Czechoslovakia and on methods of studying them, carried out in 1955–56. In the laboratory, the larvae passed through 5–7 instars in an average of 18·8–34·6 days and destroyed an average of 106·5–130·9 needles each. To observe the course of adult emergence, frames of wire netting covered with thick paper, except for one corner covered with transparent muslin, were placed over cocoon-infested soil and adults collected from beneath the muslin; these gave better results than bands of adhesive on the trees. Observations on flying adults were made by means of applications of insecticide to small areas, and on the development of the larvae by jarring the trees.

Dominik (J.). **Wykarczak** (*Criocephalus rusticus* **L., Cerambycidae, Coleoptera**) **biologia, zapobieganie szkodom i zwalczanie.** [The bionomics and control of *Arhopalus rusticus* and the prevention of damage by it.]—*Folia for. polon.* (A) 1958 pt. 1 pp. 45–128, 36 figs., 55 refs. Warsaw, 1958. (With summaries in Russian & German.)

Arhopalus (*Criocephalus*) *rusticus* (L.) is a secondary pest of pine trees that occurs throughout Poland and became numerous after the late war [*cf. R.A.E.*, A **43** 393], infesting unhealthy and damaged trees and spreading from them to healthy ones. Investigations on this Cerambycid were carried out in several areas in 1950–56, and information is here given on its morphology, bionomics, distribution and control and on the prevention of the damage, which results from the feeding of the larvae beneath the bark.

Reichart (G.) & Szalay-Marzsó (L.). **Az amerikai fehér szövőlepke elleni nagyüzemi védekezési kísérletek.** [Experiments on the control of *Hyphantria cunea* (Dru.) under commercial conditions.]—*Rec. hung. agric. Exp. Stas* **52** (C) fasc. 2 pp. 43–67, 14 figs., 11 refs. Budapest, 1959. (With summaries in Russian & German.)

In studies made in Hungary in 1955–57 on the toxicity of insecticides to *Hyphantria cunea* (Dru.) attacking mulberry trees along roads, it was found that the mortality of young larvae could be accurately estimated by counts, before and after treatment, of clusters of them on the leaves, and the mortality of both young and old ones by daily counts of individuals in muslin cages attached to treated trees. Emulsified solutions of DDT provided the most effective and economical control and, though initially slow in action, had a long-lasting effect. Trichlorphon (Dipterex) was more toxic initially, but soon lost its effectiveness. BHC and suspensions of DDT were inferior. The cost of treatment is discussed.

Nagy (B.). **Kukoricamoly okozta elváltozások és károsítási formák kenderen.** [Lesions and forms of injury on hemp caused by *Ostrinia nubilalis* (Hb.).]—*Rec. hung. agric. Exp. Stas* 1959 (Növénytermesztés) pt. 4 pp. 49–68, 18 figs., 16 refs. Budapest, 1959. (With summaries in Russian & English.)

The first serious injury to hemp [*Cannabis sativa*] by *Ostrinia* (*Pyrausta*) *nubilalis* (Hb.) in Hungary was observed in 1953 in the south-east, where a two-generation strain of the moth occurs. Investigations in 1955–57 showed that the larvae bore into the petioles and stalks, causing the leaves to wither and the stalks to bend or die back, which results in loss of fibre. Swellings frequently occurred at the point of entrance. Of all the entries, 66 per cent. were in the middle half of the stalk and 25 per cent. in the lower quarter, most being situated about 8–32 in. above the soil on stalks about 48–88 in. high. Strong, well developed plants were preferred, chiefly male ones. In a caged stand, 90 per cent. of the entries were in stalks over 50 in. tall. However, there was no correlation between the height of the plants and the degree of infestation. Hemp grown for seed is also attacked, but the inflorescences are rarely damaged.

Fjelddalen (J.). **Tomat og krysantemum—nye vertplanter for skuddtoppmidd** (*Hemitarsonemus latus* (**Banks**) **Ewing**). [Tomato and chrysanthemum—new food-plants for *H. latus* (Banks).]—*Gartneryrket* **50** no. 8–9 pp. 120–123, 6 figs., 9 refs. Oslo, 1960. (With a summary in English.)

Hemitarsonemus latus (Banks), which occurs on various plants in greenhouses in Norway [*cf. R.A.E.*, A **43** 193], was observed there for the first time on tomato and chrysanthemum in 1958–59. In tests, sprays of endrin, Kelthane or Thiodan applied twice at eight-day intervals gave good control; γ BHC (lindane) was less effective.

Agenjo (R.). **La polilla de las garrofas, plaga actual de las naranjas (Lep. Phycit.).** [The carob-bean moth, a new pest of oranges.]—*Graellsia* **17** no. 1–3 pp. 7–17, 2 pls. (1 col.), 5 figs. Madrid, 1959.

Ectomyclois ceratoniae (Zell.), which was known to attack carob beans (*Ceratonia siliqua*) in Spain, was recently found injuring oranges in the region of Valencia. The damage caused by the larva in the fruit is described.

Frit fly in spring oats. I. Sampling for first generation shoot attack.—*Plant Path.* **8** no. 3 pp. 77–82, 5 refs. London, 1959. **II. The relationship between visual and dissection estimates of first generation attack.**—*T.c.* pp. 83–90, 3 refs. **III. Sampling for second generation grain attack.**—*T.c.* no. 4 pp. 137–142, 5 refs.

The following paragraphs are based on the summaries of these three parts of a series, respectively.

Attack by the first generation of *Oscinella frit* (L.) on the shoots of spring oats in Britain can be estimated by rapid visual inspection in the field or by careful dissection of plant samples in the laboratory. Both methods are discussed in relation to the sampling errors involved, and tables are presented showing the standard errors to be expected over a range of field sample sizes. Visual data from experiments throughout England and Wales over several seasons suggest that larval infestation patterns do not vary appreciably in different parts of the country, but that attacks may have been more uniform within plots in 1954, 1955 and 1958 than in 1953.

The relation between estimates of attack by *O. frit* on shoots of spring oats assessed by a dissection technique and by visual inspection is examined. Appreciable sampling errors are involved with both methods, and, where both have been used at different times in a single experiment, these must be borne in mind before applying a correction factor to the dissection estimates prior to combined analysis in uniform visual terms. When results obtained by one method at a number of sites have to be analysed along with results obtained by the other method at other sites, the application of correction factors may be worth while, and suitable equations are suggested for this purpose. When enough well-based dissection estimates are available, it is possible to forecast the probable extent of damage that will actually be visible as deadhearts two weeks later, but it is not possible to forecast for greater periods.

Second-generation attack by *O. frit* on oat grains can be estimated by dissecting grain samples taken in the field at harvest. This method is discussed in relation to the sampling errors involved, and a table is presented showing the standard errors to be expected over a range of field sample sizes. Normal variations in the proportions of main and bosom grains [*cf. R.A.E.*, A **47** 220] in dissection samples do not materially affect the infestation estimates obtained, though careful mixing of all grain from random samples of panicles is essential before sub-samples are taken for dissection.

Gair (R.). **A Tortricid caterpillar affecting timothy seed crops.**—*Plant Path.* **8** no. 3 pp. 95–96, 1 pl., 5 refs. London, 1959.

Large numbers of larvae of *Aphelia* (*Amelia*) *paleana* (Hb.) [*cf. R.A.E.*, A **21** 497] attacked seed crops of timothy grass (*Phleum pratense*) in Leicestershire and Lincolnshire in June 1951 and in Lincolnshire and Rutland in 1958. They fed on the leaves, which they webbed together, and a few, in one field in 1958, on the seeds. The infested fields were all in their fourth or fifth harvest season and on low-lying, poorly drained soil. Notes are given on the bionomics of the Tortricid and the damage caused.

Collingwood (C. A.). **Control of bulb scale mite with endrin.**—*Plant Path.* **8** no. 3 p. 98. London, 1959.

Boxes of daffodil bulbs infested by *Steneotarsonemus* (*Tarsonemus*) *laticeps* (Halbert) that had been out of doors in central England since

October 16th 1957 were brought into a glasshouse with a minimum temperature of 55°F. on 10th January 1958. Three days later, they were sprayed with 0·1 per cent. fluoroacetamide, 0·05 per cent. methyl-demeton or 0·1 per cent. endrin emulsified with 0·02 per cent. dioctyl-sulphosuccinate, all at about two pints per box of 24 bulbs, or exposed overnight to a minimum grass temperature of 20°F. By 26th March, only plants from bulbs treated with endrin had significantly fewer infested or distorted leaves than the controls. The foliage on these was vigorous, and feeding by mites almost suppressed; the plants exposed to frost also showed increased vigour. Damage and populations of *S. laticeps* were higher on plants treated with methyl-demeton than in the controls, and this is attributed in part to the destruction by the insecticide of Collembola and predatory mites.

Richter (H.). Ed. **Pflanzenschutz. Biologische Schädlingsbekämpfung. Die technischen Mittel des Pflanzenschutzes.** [Plant Protection. Biological pest control. The technical means of plant protection.]—Sorauer (P.). *Handb. Pflanzenkr.* **6,** 2. Aufl., 3. Lief., xvi + 627 pp., 397 figs., many refs. Berlin, P. Parey, 1961. Price *DM.* 190.

The sixth volume of Sorauer's text-book deals with plant protection. The first part of the second edition was published in 1952 [*R.A.E.*, A **40** 163]. The second, which has not yet appeared, is to be on physical and chemical measures of control, and this third part is devoted to an account of biological control, occupying over 300 pages, by J. M. Franz, and a review of apparatus for the application of insecticides or other means of control, devices for the protection of workers from contamination, and the official testing of apparatus, by H. Koch & H. Goossen, which occupies the rest of the book. The two parts are indexed separately.

Hartzell (A.) & Wilcoxon (F.). **The importance of wetting agents as affecting the toxicity of certain insecticides.**—*Contr. Boyce Thompson Inst.* **20** no. 7 pp. 421–424, 5 refs. Yonkers, N.Y., 1960.

In the laboratory tests described, leaves infested by *Tetranychus telarius* (L.) were sprayed on a turntable with O,O-dimethyl S-2,3-di(methoxycarbonyl)propyl phosphorodithioate at 20 or 40 parts per million, used alone or with various concentrations of Triton X-155, an alkyl aryl polyether alchohol, as a wetting agent. The compound had no appreciable effect when used alone, but gave kills increasing from 19 and 71 per cent. to 87 and 88 per cent. for the two concentrations as the amount of wetting agent was increased from 2,500 to 10,000 p.p.m. Malathion showed similar results, with one exception, and the wetting agent alone gave 9–16 and 23–30 per cent. mortality at the two rates. It is concluded that relatively large amounts of wetting agent may be necessary to reveal the effectiveness of a toxic compound.

Gustafsson (M.). **Bekämpningsmedelsrester i gröda och jord. En litteraturöversikt.** [Residues of pesticides in crops and soil. A review of the literature.]—*K. Skogs- LantbrAkad. Tidskr.* suppl. 4, 107 pp., 18½ pp. refs. Stockholm, 1960. (With a summary in English.)

This comprehensive review of literature published up to and including 1959 is concerned with residues of insecticides, fungicides and herbicides in

and on plants, in man and domestic animals and in the soil, their possible effects, and precautions to be adopted, with special reference to conditions in Sweden.

Łęski (R.) & Smolarz (S.). **Wpływ temperatury na toksyczność DDT dla pszczół** (*Apis mellifica*). [The effect of temperature on the toxicity of DDT to the honey bee.]—*Pszczelnicze Zeszyt. nauk.* **4** no. 1 pp. 49–56, 3 figs., 9 refs. Skierniewice, 1960. (With summaries in Russian & English.)

The results are given of laboratory tests carried out in Poland on the toxicity to honey bees of DDT, which was applied topically in acetone at 15, 25 and 34°C. [59, 77 and 93·2°F.] and found to be about 25 per cent. as toxic with each 10°C. [18°F.] rise in temperature, the LD50's averaging 1·25, 4·6 and 18 μg. per bee, respectively.

Papers noticed by Title only.

Weiser (J.). **Transovariale Übertragung der** *Nosema otiorrhynchi* **W.** [Transovarial transmission of *N. otiorrhynchi* (in *Otiorhynchus ligustici* (L.) in Czechoslovakia).]—*Acta Soc. zool. bohemoslov.* **22** pt. 1 pp. 10–12, 2 pls., 17 refs. Prague, 1958.

Jermy (T.) & Sáringer (G.). **A burgonyabogár Magyarországi tápnövényei.** [The food-plants of *Leptinotarsa decemlineata* (Say) in Hungary.]—*Rec. hung. agric. Exp. Stas* **52** (A) pp. 95–116, 9 graphs, 39 refs. Budapest, 1959. (With summaries in Russian & German.)

Stark (V. N.). **A short account of the work on forest entomology in the USSR carried out over 40 years (1917–57).** [*In Russian.*]—*Rev. Ent. URSS* **37** pt. 2 pp. 221–251, 15 pp. refs. Moscow, 1958.

Malyševa (M. S.). **Leaf-cutting bees of the genus** *Megachile* **Latr. (Hymenoptera, Megachilidae), injurious to young forest plantations in the USSR.** [*In Russian.*]—*Rev. Ent. URSS* **37** pt. 2 pp. 319–329, 5 figs., 17 refs. Moscow, 1958. (With a summary in English.)

Scheller (U.). **En för Sverige ny skadegörare i växthus,** *Scutigerella immaculata* **Newp. part. Michelb. (Symphyla).** [*S. immaculata*, a greenhouse pest new to Sweden.]—*Växtskyddsnotiser* **24** no. 3 pp. 38–41, 2 figs. Stockholm, 1960.

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